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SOME STATISTICAL IDEALS.*

By John Koren.

Amid the pressure, never more clearly accentuated than now, of problems that reach into the fundamentals of our social and national existence, it may seem rather remote to speak about statistical ideals before an audience of economists and sociologists, containing but a sprinkling of professed statisticians. It would be far-fetched were I to indulge in speculations about the ultimate possibilities of a sublimated application of the statistical method. Some problem peculiar to the science of statistics could properly be discussed, but it might interest only a few. Although being concerned with ideals, I intend to touch upon practical subjects of general importance. Economists, sociologists—all of us—have at least this in common that we require that ground-work for theory as well as for practical endeavor which statistics provide. Gradually a recognition of this, the universal need of fact-bases, is becoming more and more pronounced among us. The statistician welcomes this trend toward finding out the truth about things, instead of fancifully speculating about them, for it marks an approach to the ideals he professes.

The general attitude towards statistics, and one perhaps especially characteristic of this country, is curiously paradoxical. We cry aloud for facts; there is a voracious and indiscriminating appetite for figures, or rather for the nourishment they afford to argument and propaganda; statesmen, teachers, preachers, publicists, and men in the street exemplify it. It is a dyspeptic appetite, if you please, because of the ill-assorted wares upon which it feeds. On the other hand, there is an almost equally common and more or less outspoken distrust of statistics or of the widespread application of the statistical

* Presidential address at the annual meeting of the American Statistical Association, Princeton, N. J., December 28, 1914.

method as a means of obtaining working knowledge. Whether it roots in a lack of appreciation of facts or frequently signifies merely an aversion to the alleged cut-and-dried, tedious processes by which statistics are evolved matters not. There is a common state of mind in this country which is typified by the remarks of a certain Turkish official in a reply to an English seeker after statistical information:

"The thing you ask of me is both difficult and useless. Although I have passed all my days in this place, I have neither counted the houses nor inquired into the number of the inhabitants; and as to what one person loads on his mule and the other stows away in the bottom of his ship, that is no business of mine. But above all, as to the previous history of this city, God only knows the amount of dirt and confusion the infidels may have eaten before the coming of the sword of Islam. It were unprofitable for us to inquire into it. Oh my soul! Oh my lamb! seek not after things which concern thee not! . . . God created the world and shall we liken ourselves to Him in seeking to penetrate into the mysteries of His creation? Shall we say behold this star spinneth around that star, and this other star with a tail goeth and cometh in so many years? Let it go! He from whose hand it came will guide and direct it!" *

One can sympathize with contempt for a useless prying into things that concern us not, which unfortunately marks not a little of so-called social investigation. There is much statistical delving which merits ridicule because it simply denotes a stale industry applied to matters that profit no one, an inability to distinguish between essentials and unessentials, or an unwholesome curiosity about the purely trivial. Yet the prevalent disrespect for that fact presentation which we call statistics has a deeper cause. It is not solely the too frequent neglect of the wise maxim that only persons of good repute should be permitted to officiate as statisticians, which accounts for low standards in valuing statistics. Nor is the trouble only with the inaptitude or unintelligence of the consumers of statistical products.

Perhaps we shall get closer to the truth by asking, Is

* From Sir A. Layard's "Nineveh and Babylon."

there enough conscientious endeavor to cultivate the science of statistics? Let the schools and universities answer. Where can one turn, confident of getting competent training as a statistician? I mean not merely a smattering of theory or cleverness in making diagrams, but a training that fits a man for the difficult task of mass-observations of fact, so that he is equipped to meet demands in positions of high responsibility in public or private service. It were ungracious to probe far and deep for an answer. We can find a sufficient one in the circumstance that as a rule our professional statisticians are self-taught or get their training, which often may be imperfect and one-sided enough, by the aid of others whose only schoolmaster had been experience. In an exceptional office one may have the good fortune to come under the tutelage of a man of broad views and unswerving high aims, and at least imbibe certain statistical ideals. But this is a rare exception.

The uncontrovertible truth is that our universities do not take the lead in this respect which rightfully belongs to them. The stepmotherly treatment generally accorded statistics as a discipline, I need not specify. There are the curricula—you know them better than I—they speak for themselves. Where is the leadership of our schools of learning in actual statistical work? Take by contrast a country which is not precisely popular in the United States at the present time, but which at least is giving abundant evidence of marvellous efficiency. One may venture so far as to say that its efficiency rests in no small part upon training in assembling and interpreting facts. In Germany, it is the Herr Professor and Doctor, himself trained in the schools, who directs statistical activities whether at the head of national undertakings or as the principal of municipal statistical bureaus or in other similar capacity. Of other countries, France, Italy, Austria-Hungary, and many smaller ones, the same is true, if perhaps in a lesser degree. It would be an evasion of the issue to say that our conditions do not afford opportunities of a similar character. The truth is rather that our universities do not provide men to seize the opportunities at hand. At bottom lies the fact that the training is not afforded which fits for leadership. Only the unusual man is capable of attaining it without the

preliminary guidance which might equip those of lesser native talent.

Perhaps one reason, but hardly an adequate excuse, for the neglect of statistics in our learned schools is the difficulty of teaching the subject. Yet it can be done successfully so as to serve the double purpose of training statisticians and preparing others to become discriminating consumers of statistics.

It is an ungrateful task to point out these commonplace grievances; but if we are to speak of ideals it is necessary first to account for some perfectly obvious shortcomings of the present day. The unreasoning attitude many take toward statistical work is all too explicable. The spurious article parading under the name of statistics circulates without let or hindrance. Perhaps later on its lack of genuineness may be revealed, but then the mischief is done. It is not merely a question of hunting down these statistical untruths, an almost hopeless chase, but of their effect upon our habits of thought. Then there is a singular superstition that anyone, no matter how completely lacking in training, and even ordinary aptitude, may be employed in pretentious statistical undertakings. The schools of learning are not guiltless in this respect, nor are the private organizations that profess a certain leadership. Under such circumstances it is hardly becoming to blame severely the appointive powers when they so frequently place men in offices of high responsibility to whom statistics is a meaningless term.

It is not open to dispute that, speaking generally, we have a statistical output which is as lacking in quality as it is truly appalling in quantity; that a multitude of so-called investigations show still-born results; and that other statistical inquiries simply weary the student because they yield nothing worth while and therefore fail to instruct. What wonder that there is more or less articulate protest against the waste of time and effort in statistical work, coupled at times with an emphatic condemnation of efforts to pry into affairs that concern us not! Why wonder at the prevalent skepticism toward statistical statements, although some of those who exemplify it would by no means be deprived of the opportunity for making such statements! And, lastly, what wonder that the profes-

sion of statistics has not quite attained the honorable place in this country which is its right! Much of this may sound trite and elementary but must be reiterated until better conditions emerge.

Here, then, are indicated some of the modest statistical ideals toward which we should strive. The basic requirement is that the schools of learning should do their duty in affording a training that will enable men not only to become students of statistics but to engage in the profession of statistics. The demand for qualified workers grows more and more insistent, while efforts to meet it continue to lag. The urgency of the situation is almost too patent for discussion. Under the tutelage of the universities as well as of statistical offices of recognized standing, the pretentious tribe of incompetents who bring the very name of statistics into disrepute would be supplanted by trained observers of and earnest seekers after facts. We should no longer witness the distressing spectacle of well-meaning but untrained men and women being set at tasks which profit not and spell waste of public and private money. The profession of statistics would attain that dignity and public confidence to which it is entitled. And under the conditions sketched it seems reasonable to expect that the present attitude of the consumer of statistics might be happily modified. He would learn to cultivate an appetite for wholesome things and be saved the ills of a statistical indigestion which now only the wary can escape. Lastly, there would be put at the disposal of men of the learned professions the material that is so necessary in much of their work.

If there is abundant reason in this country to ask forgiveness for statistical shortcomings, there is as ample cause to seek for wisdom and intelligence in order to do much-needed work well. To enumerate all of it would be tedious and a repetition of the fairly obvious. I will, however, venture one suggestion. We must learn to show greater patience in acquiring elementary facts in the wide domain of statistics. This is one of the greatest needs; the refinements can wait. Our proneness to reason and act, through legislation and otherwise, upon insufficient fact bases, to make a fetish of theories without subjecting their value to the simplest test, do not make for intelligent progress, no matter what political or social problem is involved.

Passing by the wide fields of fact which need to be industriously explored, I wish to direct your special attention to the question of organization for statistical efficiency. Without doubt a large part of the existing confusion, and the uncoördinated and often disappointing results of much statistical work are to be sought in defects of organization. I am of course here referring chiefly to official statistical offices, and am not concerned with details but with certain general principles. Let me illustrate by an example. The tremendous statistical machinery operated by the federal government is known to us all. Its growth has been somewhat haphazard; the parts do not all fit; there is duplication of work, unnecessary friction, and waste. In short, it is not the effective engine it should be and can be made. Various reasons may be assigned for this. Statistical offices are sometimes filled with an eye to politics rather than to fitness; proven ability may not lead to promotion or adequate compensation. But far more vital has been the absence of a competent guiding hand in shaping the activities to be set in motion.

The situation demands improvement. And the means? Let us assume that there were created by Congress a Central Statistical Commission composed of the heads of Government departments and bureaus that have important statistical work to do, reinforced by a specified number of men drawn from societies like the American Economic, Sociological, and Statistical Associations, the Actuarial Society, and perhaps other learned organizations, and with other members adequately representing the professions of medicine and law and special branches of learning like biology. Assume also that such a Commission be given adequate advisory powers to deal with all that pertains to statistical organization, planning, and work within the federal government. Ought it not to become a powerful agent for smoothing out defects, raising standards, cultivating the now bare spots in the statistical fields, and thus bring us a little nearer the ideal service?

I offer you no new idea. Suggestions similar in nature have already been brought to the attention of officialdom. And outside of Germany and England there is to my knowledge not a single country without a central statistical commission upon

which uniformly men of the highest distinction and attainment are known to serve.* I cannot find any valid reason for believing that we should fail if the experiment were tried. That anyone among us should refuse the honorable place upon such a commission is unthinkable. But unless the impulse toward its establishment comes from us, we shall expect it in vain.

Hitherto we have as a body largely been content with fault-finding, which has had its uses, no doubt, but of course has lacked constructive force. The stake is too large to permit us any longer to remain outside as passive critics. We have a duty and cannot divest ourselves of responsibility.

The principle of participation in official statistical work, just alluded to, is as applicable to state and municipal activities as to those of the federal government. At least in some states there are men and institutions sufficiently qualified to exercise an advisory leadership in statistical undertakings which too often miss fire for want of it. Just now, for instance, several states are preparing for censuses. Whether their results will measure up to expectations should be our concern from the moment of the first preparation for the work. Here and there are signs of a new feeling of responsibility in these things, but concerted action is still wanting. Has not the time come to organize for it? I address this question chiefly to members of the American Statistical Association, but also to the economists and sociologists.

I am conscious of having taken the unwelcome part of a critic, that I have dwelt on somewhat obvious elementary conditions and needs, perhaps with a tinge of preachment. Probably I shall be forgiven for the sake of those still unattained ideals which we all profess and toward which, I trust, we are slowly moving.

* In Germany, many of the different states possessed competent statistical organizations before the Empire brought them into closer confederation. The Imperial Statistical Office largely supplies the need of a Central Commission. So far as England is concerned one may modestly hold that such a Commission would be useful.

A STANDARD ACCIDENT TABLE AS A BASIS FOR COMPENSATION RATES.

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The rapid growth of compensation legislation in this country has created a sudden demand for accident statistics which the American statistical literature was utterly unable to meet. The majority of American compensation acts are based upon private compensation insurance which may be solvent only when based upon accurate premium computations. The German method of assessment insurance for industrial accidents can only be successful when built upon a compulsory organization of the insurance carrier. This method has been followed in a few states only, notably Washington and West Virginia. The difficult problem of calculating proper rates for compensation insurance, rates which should not be excessively high and yet sufficient to meet all the slowly developing charges resulting from accidental injuries, found the business of casualty insurance somewhat unprepared. The development of compensation legislation was so precipitated and so unexpected that there was little time to prepare the necessary material.

As compensation was a substitute for the discredited system of employer's liability, so insurance of the obligations created by compensation acts developed out of the methods of employer's liability insurance. Naturally enough the casualty companies (that is the insurance companies writing so-called miscellaneous lines, including almost all lines outside of life, fire and marine, liability insurance being the most important of these) were forced to rely upon the experience under liability insurance for making hurried estimates as to the probable cost of accident compensation. It became evident very soon that the two systems were entirely different, not only from the point of view of social justice, but also from that of insurance practice. The experience under one was of little

service in shaping methods for the conduct of the other branch of insurance. For the benefit of statisticians not familiar with the conditions of employer's liability insurance these may be briefly stated here:

An employer's liability insurance contract obligates the insurance company (for a certain consideration stipulated in advance and known as the premium) to reimburse the insured employer in case he is called upon to pay damages for accidental injuries sustained by his employees in accordance with the verdict of a court. In practice the insurance company, in order to reduce the possible losses through such court verdicts, undertakes to defend the suit and also endeavors to settle amicably out of court as many suits, or claims threatening to become suits, as possible. Naturally, the losses, while depending upon the frequency and severity of the injuries sustained, do not at all bear any definite relation to them. Perhaps in an equal degree they depend upon the stringency of the liability legislation of each particular state, upon the nature of the court decisions as to the validity of the "Three Defenses," upon the skill of the attorneys in defending suits and arguing appeals, and upon the efficiency of adjusters to settle a large number of claims before the injured employees are tempted to bring suit against the employer.

In compensation insurance the cost in any one industry evidently depends entirely upon the number and character of the injuries occurring in that industry, as well as upon the amount of compensation granted by the particular law. Under employer's liability laws there frequently is no logical or equitable relation between the character of the injury and the cost of settlement. Very much more depends upon the existing legal evidence as to the cause and the manner of occurrence of the accidents. For this reason the legal features of the cases are much more carefully studied than their surgical or medical features. Every large casualty company had some sort of a statistical organization even before the advent of compensation legislation, but the statistical work done approached the problem from a different point of view. The experience studied dealt largely with the relations between money losses paid and premiums collected, or the exposure in

dollars of pay roll, so as to obtain either the loss ratio or the so-called pure premium.*

Very seldom were the accidents reported studied, and almost never were their physical nature or their economic effect upon the earning capacity of the wage-earner considered.

This experience for numerous minute subdivisions of industry was almost the only available source of information upon which to build compensation rates. No wonder then that the rates at first proposed were in the nature of guesses only, and many of them went far beyond the mark. An effort was made by the central rate-making organization of the casualty companies to utilize the experience of the so-called workmen's collective insurance.† This is a form of insurance more closely approaching workmen's compensation because it covers employees of certain establishments for all accidental occupational injuries irrespective of fault, and the benefits are subject to a definite schedule, though very much more limited than any schedule of benefits under compensation. The records of this form of accident insurance, had they been properly kept and had there been enough of them, would have presented very valuable information as to the number and nature of accidents in separate industries. Unfortunately the volume of this business available to the rate-making bureau was much too small, perhaps a paltry $100,000,000 of wage exposure, equal to some 200,000 employees working for one year. This amount, divided into many different industries, leaves very little to depend upon for most independent industries. Besides, the actual records were very far from satisfactory as to the nature of the injury and duration of disability. Instead of the accident experience under these collective policies, their loss experience was utilized as a starting point and the rates charged for

* By loss ratio is meant the percentage proportion between losses and premiums. By pure premium is understood the cost of losses per hundred dollars of wages paid by the insured employer to his employees. This method of computation, as well as the reference of all computations to the exposure of wages paid rather than persons employed, is unsatisfactory from the point of view of theoretical accident statistics, but is explained by the conditions of the business. Ideal accuracy would undoubtedly require that the number of employees and the time spent in work be computed, but there are so many practical difficulties in the way of accurate determination of these facts by thousands of independent employers that the rough and ready measurement of the risk by the volume of pay roll in practice presents much more accurate results.

† See article, "Establishing Rates for Workmen's Compensation," by Theodore E. Gaty, *Market World and Chronicle*, January 11, 1913.

insurance under that form of contract. But as these rates were originally computed from very limited data, the building could not be stronger than the foundation. There is no doubt that the dissatisfaction of employers with the conduct of compensation insurance during the first experimental years was largely caused by the absence of accurate data from which scientific rates could have been built.

The question has often been asked why the voluminous and carefully studied accident statistics of European countries has not been utilized at this critical moment. Germany, for instance, having begun insurance against industrial accidents nearly thirty years earlier, possesses almost a library of statistical material on this problem. There were several reasons why that experience was not and could not have been utilized.

To begin with, a widespread feeling of skepticism in regard to all European experience may often be found even among students of social conditions, and is especially strong among practical American business men. While in life insurance mathematically accurate data have been in use for many decades, casualty insurance is still managed very largely as a business and very little as a science. Knowledge of foreign statistical sources among casualty men, with a few notable exceptions, was rare. It was easy to argue that European statistics were utterly inapplicable because, as everyone would readily admit, our own industrial activity is so much more hazardous, accident prevention less known, factory inspection less efficient, and for these reasons the number of industrial accidents is very much greater. Moreover, the various European compensation acts are quite different from each other, especially in their provisions as to the prescribed scales of compensation, and the American acts still more different from the European acts, and unfortunately, from each other.

Furthermore, European accident statistics are published and studied according to many different methods. Efforts to establish a uniform system of accident statistics in Europe though advanced by the International Statistical Institute have not as yet been successful. The definition of what constitutes an accident, the distribution of accidents into groups according to their surgical and economic results (that is as to

the physical nature of the injury and as to its effects upon the earning capacity of the victim) the classification of industries used, etc., all this is different in every known statistical source. Finally, the statistics published are in such a form as to be much more useful for general social purposes than for the computation of rates. It may be very instructive to know that the accident frequency in the metal working industry is 50 per cent. higher than in the woodworking industry, but the insurance carrier does not undertake to insure either the one or the other. Insurance must be written and rates quoted for certain industrial establishments manufacturing definite articles or for contractors performing definite jobs, and no European source presents its data in sufficient detail to meet the demands of the practical casualty underwriter for specific information in regard to some 1,500 different classifications of industrial undertakings. All this explains why it is impossible to draw directly upon European sources for the necessary information. Does it follow, therefore, that all European experience is altogether worthless to help meet the difficulties arising out of the application of compensation acts in this country during the first few years?

In an article published early in the history of compensation* the writer suggested a method for computing compensation rates by means of utilizing all possible American and European statistics. The method suggested may be outlined by means of the following quotations:

All scientific rates must include the following three elements: first, agent's commissions; second, expenses of central administration; third, the pure cost or pure premium. In the matter of workmen's compensation in the United States, the first two of these items depend entirely upon American conditions, and are easily controlled and computed. All the uncertainty, all that is still obscure, lies in the third item—the factor of pure cost or pure premium.

Now, the pure premium itself may be resolved into three factors: first, the accident rate; second, the proportion of the various classes of accidents (that is as determined by degree of disability, duration of disability, etc.), to the whole number of accidents; third, the compensation scale to be used.

*Arriving at the Cost of Workmen's Compensation in the United States, *Market World and Chronicle*, June 22, 1912.

Summarized, the plan calls for the following operations: first, determine the rates of accident in the various industries on the basis of American experience; second, determine the relative proportion of fatalities of permanent disability cases, partial or total, and the relative duration of temporary cases, on the basis of European experience; third, apply to the results thus obtained through the combination of American and European experience the various compensation scales of the various American compensation laws.

The first suggestion outlined above, as to what may be termed accident frequency, had in view a possible utilization of the many thousands of accident reports transmitted to the casualty companies by their policy holders. For a careful study of accident statistics these reports are of little value because of their faulty character, but it did seem to the writer that the simple count of these reports for each separate industry might give a sufficient indication of relative accident frequency.

The most important part of the plan is contained in the second suggestion that European experience might be utilized for the purpose of distributing accidents into groups according to gravity. This suggestion has found enthusiastic support among some actuaries and insurance statisticians, while it has been severely criticized by others. One may perhaps be excused for stating this suggestion in the terms originally used:

> It is when we come to the proportion of the various classes of accidents that we meet with the greatest difficulties for here we have almost no available American experience at all . . . we must look for light elsewhere . . . until we have gone far enough with workmen's compensation in the United States to have our own experience. . . . As regards this problem of the nature and effects of injuries . . . there can be no great differences between one country and another. An examination of the statistical material of various countries shows that there is practically no variation from country to country. It appears that whatever its nationality, the human machine is a human machine, and that its average resistance to injury and its average speed of recovery from injury vary very little.

As regards the first suggestion that the accident frequency of various branches of industry be ascertained from all records of casualty companies dealing with liability insurance, it has

never been practically utilized. With the rapid accumulation of experience under compensation insurance, the necessity for making use of this method is passing away. While the failure of the casualty companies to make use of the plan proposed seems unfortunate because it might have prevented many errors, this at present is a matter of purely historic interest.

The second suggestion as to the method of studying accident gravity was destined to play a more important part in the development of compensation legislation and insurance. Though extremely simple in itself and almost obvious to anyone who has made any study at all of foreign accident statistics, it appeared like a new scientific clue to many actuaries who were groping for some practical method of computing the cost of compensation. It was impossible to make any direct comparisons between the American compensation scales and those of Germany or France and determine in that way the relative cost of the different acts. The differences in the scales were so many that it was necessary to weight each difference in these provisions in accordance with the frequency with which it might come into play, and the comparative share of each group of accidents in the total cost of all.

As far as the writer's information goes, Professor A. W. Whitney, at that time consulting actuary of the California Industrial Accident Commission, was the first to make use of the above suggestions, and apply a hypothetical distribution of accidents based upon European experience to this problem, to determine the probable cost of the proposed California Acts as compared with the then California Act and with other acts in existence at the time.* Another Californian student of the problem, Mr. A. H. Mowbray, a consulting actuary who was chairman of the Social Insurance Committee of the Commonwealth Club of San Francisco, has also applied this method to a comparison of the proposed California Act with the existing Illinois and Massachusetts Acts.† Mr. Mowbray made a careful analysis of the statistics of various countries as pub-

* See "Memorandum concerning a proposed scale of Compensation Benefits to be paid to Workmen injured through industrial accident now under consideration by the Industrial Accident Board of California," 1912.

† See a typewritten memorandum, entitled "A Suggested Basis for the Determination of Comparative Costs of Different Compensation Schedules, and Some Comparisons thereof."

lished in the twenty-fourth Annual Report of the United States Commissioner of Labor, and concluded that "the close agreement" between these various statistical data "seems to strengthen the case in favor of Mr. Rubinow's hypothesis."

Thus the plan outlined above was never used in its entirety for the purpose of computing compensation rates, but it proved to be quite adaptable to the specific purpose of ascertaining the difference in the cost of different compensation acts, or what may be called a differential between different acts.

While the efforts of Professor A. W. Whitney and Mr. A. H. Mowbray were of theoretical importance only and did not serve as a basis for rate computation, the first practical application of the method occurred in connection with the New York Compensation Act, passed by the New York Legislature in December, 1913, to go into effect July 1, 1914. The act conferred upon the New York Insurance Department the duty of passing upon the adequacy of the rates to be charged for compensation insurance. The declared purpose of this legislation was to protect the policy holders as well as the injured employees against the possible danger of insolvency of the insurance carriers, which might result from inadequate rates. In order to act intelligently under the new power conferred upon it, the insurance department faced the problem of establishing some standard measure of rate adequacy at the time the New York Compensation Act, different from all other acts and more generous than most of them, was going into effect. The problem appeared extremely difficult, almost insolvable. A comparison with the rates in force in other states at the time did not seem helpful, since these rates were subject to many criticisms. Fortunately, the Insurance Department of Massachusetts, which had called upon the insurance companies early in 1914 to furnish results of compensation insurance in that state, was able to prepare the experience (that is, the relation between losses sustained, premiums received, and the wage exposure) on some $500,000,000 of wages by separate industrial classifications. Thus some basis for calculation of pure premiums was available. The rate-making bureau of the casualty companies agreed to utilize this volume of experience in computing New York rates.

The writer was consulted by the actuaries of the New York Insurance Department and was asked to suggest a method for comparing the cost of the two acts. The method suggested embodied the principles above outlined, that is, a separate valuation of a given series of accidents, reflecting the normal distribution according to gravity, under both acts, and the comparison of the resulting cost. By a happy coincidence the preliminary results of the tabulation of industrial accidents in Massachusetts for the first year of operation of the compensation act (July 1, 1912, to June 30, 1913), made by the Industrial Accident Board of that state, also appeared at the time. The 90,000 accidents reported in Massachusetts were therefore used as a basis for the computation.

The problem assumed the following form: how much would these 90,000 accidents cost according to the Massachusetts law and how much according to the New York law, a proportion between the two amounts being the true differential between the laws of the two states.

But while the Massachusetts report was extremely useful, it did not analyze its material in sufficient detail to enable one to compute the cost accurately. Especially was the report unsatisfactory in regard to the question of permanent partial disability, the number of such cases, and the degree of disability resulting. As the New York Act is extremely liberal in regard to such cases, they represent a very substantial part of the entire cost of compensation, and some conception as to their number and gravity was absolutely necessary. For this purpose very detailed figures of Austrian and German accident statistics (analyzed in the twenty-fourth Annual Report of the United States Commissioner of Labor) were recommended. This was perhaps the first formal application of European experience to American compensation insurance.

The discussions accompanying the adoption of the New York compensation rates emphasize the great necessity of some scientific method for computing such rates for all compensation states. In most other states where compensation acts were in operation grumblings were heard against exorbitant and inequitable rates. Comparisons of rates in different states for identical industries were made by industrial accident

boards as well as private employers, and justifications for the differences disclosed were urgently demanded. The difficulties created by the co-existence of so many different acts were obvious. Not only did this make the work of preparing rates for each state so much more difficult, but it also vitiated comparisons of experience unless some method of equating these differences were applied.

To Professor A. W. Whitney (who became general manager of the Workmen's Compensation Service Bureau early in 1914) credit is due for the plan of bringing the insurance rates in all compensation states into harmony through a proper system of differentials instead of trying to prepare an independent schedule of rates in each state on the basis of its own experience.

Systems of state differentials were not altogether new in casualty insurance. They had been in use for a time in connection with employer's liability insurance. But while the old system of state differentials was largely a result of underwriting judgment (as to the comparative stringency of liability laws and as to the general conditions in various states) Professor Whitney's plan presupposed a scientifically accurate objective method of computation.

For the purpose of devising such a method a committee of casualty insurance experts was appointed by Professor Whitney.*

It was agreed that the method of computing costs of a given number of accidents, as advocated by the writer, promised the most satisfactory results. Instead of trying to depend upon the unsatisfactory accident statistics of any one of the American states or foreign countries, it was decided to establish one definite standard schedule of distribution of accidents according to gravity of the result, or in other words, to construct something akin to the standard mortality table in life insurance. This first step necessary for the computation of differentials was entrusted to the writer. The study which follows was prepared in response to this demand. As far as the writer is aware, it is the first effort of its kind ever made in

* This committee consisted of Mr. B. D. Flynn, Assistant Secretary of the Traveler's Insurance Company of Hartford, Conn., Mr. Stanley L. Otis, Actuary of the Workmen's Compensation Service Bureau, Mr. C. E. Scattergood, Assistant Secretary of the Fidelity & Casualty Company, and the writer for the Ocean Accident & Guarantee Corporation.

the domain of accident statistics or compensation insurance. It has been adopted by the committee mentioned above, whose work received the unanimous approval of the Workmen's Compensation Service Bureau, and it lies at the foundation of almost all compensation insurance rates at present in force in this country.

Definition of an Accident.

In endeavoring to use European statistics and especially to compare the data of one country with those of another, the first serious difficulty is that arising out of the differences in regard to the definition of what constitutes an industrial accident. Reports on accident statistics have been strongly influenced by the provisions of compensation laws. In fact, there were scarcely any satisfactory accident statistics in any country previous to the enactment of compensation acts. There are, however, many differences between compensation acts as to the kind of accidents covered by their provisions. Several acts leave the care of minor accidents to other co-existing institutions, especially where a well organized system of sickness insurance is found. Thus, to quote the best known illustrations, in Germany all accidents for the first thirteen weeks, and in Austria those for the first four weeks, are left to the care of sick benefit funds. Naturally, only those accidents come under the compensation system which result in losses extended beyond this minimum period. In other countries injuries lasting less than a certain minimum length of time are left uncompensated altogether. In most cases the published accident statistics disregard accidents which do not extend beyond this so-called waiting period. Thus, German accident statistics cover only accidents leading to death, permanent disability, and temporary disability of over thirteen weeks. In Austrian statistics, accidents leading to temporary disability under four weeks are excluded; in Italy, those under five days; in Russia, those under four days; in France, under three days, etc. Evidently, since the number of such minor accidents is very large, the percentage of all classes of serious accidents whether resulting in death or permanent disability, etc., will depend very much upon how many of those small

accidents are included, or in other words, will depend entirely upon the accepted definition of an industrial accident.

This difficulty does not necessarily make European data useless, but it requires an adjustment before comparisons are made, so that before the figures of any country are to be used, all accidents which do not come under the uniform classification must be eliminated, and on the other hand, for such countries as Germany and Austria where the definition of an accident is very narrow, the figures must be adjusted by means of some factor to compute the probable number of accidents under the uniform definition.

Only after such adjustments are made does the principle hold true that the distribution of accidents according to gravity and consequences is fairly uniform in all countries. This is well illustrated by the following example showing the comparative distribution of 42,063 accidents treated by the Leipzig sick fund and 154,926 accidents occurring in Russia for the three-year period, 1904 to 1906:

Classes of Accidents.	Germany.		Russia.	
	Number.	Per Cent.	Number.	Per Cent.
Under 4 weeks	32,235	76.16	113,353	73.13
4 to 13 weeks	7,618	18.58	32,896	21.28
Over 13 weeks	1,968	4.68	7,596	4.90
Fatal	242	.58	1,081	.69
Total	42,063	100	154,926	100

A comparison of the figures in the above table seems to indicate a certain substantial difference between the distribution of accidents in the two countries compared. As a matter of fact, the difference is that in the German sick funds a good many minor cases have been reported which have been eliminated from the Russian statistics because of their duration being under four days. This reduces the total number of accidents but increases the percentage for the classes over four weeks, over thirteen weeks, and fatal, at the same time reducing the percentage of accidents under four weeks. These figures are here computed on a basis of one fatal accident. We find the following series expressed in multiples of the number of fatal accidents:

	Leipzig.	Russia.
Fatal accidents	1	1
Over 13 weeks	8	7
Over 4 and under 13 weeks	31	30
Under 4 weeks	133	105

This clearly indicates the remarkable similarity between the statistics of the two countries except for the group of accidents of under four weeks' duration, where the material difference is explained by the considerations stated above.

The definition decided upon is identical with that accepted by the Statistical Committee of the Workmen's Compensation Service Bureau for the study of accident statistics of the casualty companies; namely, only such accidents are to be counted and studied which disable the injured employee for any time other than the day of injury. The same definition was accepted by several conferences of officials of bureaus of labor and by the American Association for Labor Legislation, and promises to become the standard definition of an industrial accident in the United States. It is practically equivalent to excluding accidents leading to disability of less than one day, because the injured person who does not return to work in the beginning of the day after the injury, is not likely to return at any time during that day.

This definition of an industrial accident is very much broader than that used in most governmental studies of accident statistics. However, a precedent may be found in the statistics of accidents to employees of the United States Government recently published.*

There are practical reasons for selecting this definition. Even under liability insurance conditions, casualty companies were insistent that the minor injuries be carefully reported because the most trivial injury occasionally developed into a substantial claim or suit. The accident reports, or "notices" as they are technically designated, have been much more numerous than accidents of sufficient gravity. A narrow definition of "accident" would have entirely destroyed this basis of underwriting experience.

*See *Compensation for Injuries to Employees of the United States Arising from Accidents Occurring between August 1, 1908, and June 30, 1911*, published by the Department of Commerce and Labor, Washington, 1913.

Certain difficulties are created by this definition because there is very little statistical material available to indicate the number of these minor accidents, and adjustments of almost all data become necessary. For the purpose of such adjustment, use was made of the statistics of injuries to United States employees, as explained below.

Five Groups of Accidents.

Having accepted the standard definition, the problem is to ascertain the following relations:

First—The relative number of fatal accidents.

Second—The relative number of permanent total disability cases.

Third—The relative number of dismemberments and their character.

Fourth—The relative number of permanent partial disability cases and their distribution by degree of disability.

Fifth—The relative number of temporary disability cases and the distribution of such cases according to duration.

While it would be quite practicable to deal in percentages extending the figures to any necessary degree of accuracy, it seemed preferable to assume a standard total sufficiently large to permit of all necessary sub-divisions and yet not so large as to appear quite fanciful. The number of 100,000 was decided upon since in many of the larger states that many industrial accidents will occur in a year or two. The advantage of such a large base is that in the computations individual cases are dealt with and not fractions of cases.

The above division into five groups is necessitated partly by the nature of the problem and partly by the peculiarities of the American compensation acts. There is a very fine line of demarcation between permanent partial disability and permanent total disability, but an independent determination of the latter cases becomes necessary because special provisions for them are made in most American acts. Still more important is the treatment of cases of dismemberment by specific benefits in American acts, instead of considering the proportion of earning capacity lost, which is the European method. Of these five sub-divisions, some are due to definite physical

facts, so to speak, and not dependent upon differences in interpretation of the law. This includes fatal accidents, the number and character of dismemberments, and perhaps the distribution of temporary disability cases according to duration. On the other hand, when we deal with cases of permanent partial disability, and especially their distribution by degree of disability, we are dealing with facts which are largely influenced by differences in interpretation of law, and here the largest variation between one country and the other may be expected. In utilizing the statistics of foreign countries for the purpose of computing each one of these five groups of accidents, different checks and tests must therefore be introduced.

Fatal Accidents.

The experience of Massachusetts for the first year of the application of the Compensation act, as reported by the Industrial Accident Board, gives 474 fatal accidents out of the total of 90,168, or some 525 per 100,000. The Massachusetts report has no definition of accidents but counts all accident notices received. The following figures indicate the importance of adjusting the accident definition for the purpose of obtaining the percentage of fatal injuries:

Percentage of Fatal Accidents in Various Countries.

Massachusetts (1912–1913)—0.5 per cent. of all notices.

Leipzig Fund (1887–1903)—0.6 per cent. of accidents of over three days' duration.

Russia (1900–1906)—0.7 per cent. of accidents of over four days' duration.

Italy (1902)—0.75 per cent. of accidents of over five days' duration.

Austria (1897–1901)—4.1 per cent. of accidents of over four weeks' duration.

Germany (1899–1908)—8.4 per cent. of accidents of over thirteeen weeks' duration.

In not a single instance do we find a definition of "accident" which would correspond to the one adopted here. To make the Massachusetts data conform to this definition, it is necessary to eliminate from the 90,168 notices those accidents where

duration of disability did not last over one day. Their number is not stated in the report, but it is indicated in a diagram that in 41 per cent. of all non-fatal accidents the disability did not last over one day:

90,168 − 474 fatal accidents = 89,694 non-fatal accidents.
89,694 × .41 = 36,774 accidents of not over one day's duration.

Deducting these, the total number of accidents in Massachusetts in 1912–1913 is reduced from 90,168 to 53,394, and the 474 fatal accidents constitute 0.888 per cent., or 888 per 100,000 accidents.

Before these figures are accepted, comparisons with a few other countries are necessary. In Austria from 1897 to 1901 there were 3,871 fatal accidents out of a total of 95,269 accidents of over four weeks' duration. To adjust this to our standard American definition of an "accident" the following method may be used:

According to the report on accidents among United States employees for 1908 to 1911, the 20,835 accidents were distributed as follows:

Duration.	Number.	Per Cent.
1 to 7 days	7,482	35.9
7 to 14 days	3,753	17.0
15 to 28 days	4,238	20.3
All other	5,362	25.8
Total	20,835	100.0

As accidents of over four weeks' duration constitute 25.8 per cent. of all accidents of over one day's duration, we may assume that the 95,269 accidents of over four weeks' duration in Austria correspond to 95,269 ÷ 25.8 per cent. = 369,260 accidents of over one day's duration, on which basis Austria shows 1,048 fatal accidents per 100,000.

For a period of ten years the German industrial accident associations reported 54,166 fatal accidents out of a total of 642,344 accidents of thirteen weeks' duration, the fatalities constituting 8.43 per cent. Again, the United States statistical report referred to above indicates that accidents of over

thirteen weeks' duration constitute only 8.89 per cent. of all accidents of over one day's duration. The number of accidents of over one day's duration in Germany for the ten years would be equal to 642,344÷8.89 per cent.=7,225,460, and the number of fatal accidents per 100,000 would be 750. In Italy a report for 1902 shows 430 fatal accidents out of a total of 57,617 accidents of over five days' duration, or 746 per 100,000. In Russia for a period of three years there were 2,345 fatal accidents out of 299,874 accidents of over four days' duration, or 782 per 100,000. In both these latter cases the true average would be somewhat smaller if all the petty accidents had been included. The United States report shows 670 fatal accidents out of a total of 20,835, or 3,216 per 100,000, which is evidently too high a figure explained by the very hazardous nature of the occupations covered by the Act of 1908. Averaging the fatal accident frequency in only four countries, Austria, Germany, Italy, and Russia, where a fairly general distribution of industries and occupations obtains, the average is 837 per 100,000, which is not very far from the Massachusetts figure of 888. In accepting the latter figure, it must be remembered that the Massachusetts report was prepared very soon after the completion of the year. Experience in Germany has demonstrated that within four or five years the number of fatal accidents increases by about 5 per cent. because of the subsequent death of many injured persons whose injuries originally did not appear to be fatal. Loading, therefore, the accepted figure by 5 per cent., we arrive at 932 fatal accidents per hundred thousand injured.

Dismemberments.

Because most American acts contain specific schedules of benefits for cases of dismemberment, it is necessary to make an estimate of their number as well as the distribution among different kinds of dismemberments. As these cases are not treated in that fashion under the European compensation acts, comparatively little information is available. The best is that contained in the Austrian report for 1897 to 1901, which is the only source for exact data as to distribution of as large a number as 8,686 cases of dismemberment according to the exact nature of the loss sustained in each case.

Some test is necessary to establish how far the proportion of dismemberments differs, if at all, from such American experience as we have. The Massachusetts report shows 967 dismemberments out of a total of 90,162 accidents. To make this comparable with the Austrian figures, all accidents of under four weeks' duration must be eliminated, leaving only 11,237 accidents of over four weeks' duration. Dismemberments constitute 8.6 per cent. of that number. Of the Austrian 8,686 cases, 109 resulted fatally, leaving 8,577 cases, which in proportion to the 95,269 accidents of over four weeks' duration is 9 per cent. As Austrian figures are more complete because a certain number of cases must lead to amputation some time after the original injury has been sustained, it is felt that the Austrian and Massachusetts figures on that point are sufficiently comparable to permit the use of the Austrian figures. The experience from Michigan as reported in the *National Compensation Journal* of June, 1914, for six months, December 1, 1914, to May 31, 1914, gives 318 dismemberments and 6,046 cases of temporary disability, giving a proportion of about 5 per cent. But the Michigan report includes all accidents of over two weeks' duration. As the number of accidents of from two to four weeks' duration is approximately equal to the number of accidents of over four weeks' duration, it would indicate that cases of dismemberment in Michigan amount to about 10 per cent. of all the accidents of over four weeks' duration, which is even higher than the Austrian figures. Therefore, on the whole, the Austrian figures may be accepted. In the following statement is given a classified list of dismemberments occurring in Austria within the period specified, and also the number per 100,000 on a basis of all accidents of one day's duration or over, for which purpose the 95,269 accidents of over four weeks' duration were assumed to represent 369,260 accidents according to our accepted definition.

Kind of dismemberment.	Number of cases in Austria, and whether resulting in permanent disability or not, but exclusive of cases resulting fatally.	Number per hundred thousands on an assumption of 369,260 cases.
1. Loss of left arm	239	65
2. Loss of right arm	352	95
3. Loss of left hand	183	50
4. Loss of right hand	225	61
Loss of entire fingers, two phalanges or more:		
5. Loss of left thumb	106	29
6. Loss of right thumb	114	31
7. Loss of left index	219	59
8. Loss of right index	255	69
9. Loss of left middle finger	96	26
10. Loss of right middle finger	116	31
11. Loss of left ring finger	51	14
12. Loss of right ring finger	63	17
13. Loss of left little finger	118	32
14. Loss of right little finger	127	34
15. Loss of thumb and one or more fingers, left hand	51	14
16. Loss of thumb and one or more fingers, right hand	62	17
17. Loss of two or more fingers, left hand	232	63
18. Loss of two or more fingers, right hand	245	66
Loss of one phalange of finger:		
19. Loss of left thumb	203	55
20. Loss of right thumb	228	62
21. Loss of left index	307	83
22. Loss of right index	343	93
23. Loss of left middle finger	191	52
24. Loss of right middle finger	194	53
25. Loss of left ring finger	91	25
26. Loss of right ring finger	71	19
27. Loss of left little finger	66	18
28. Loss of right little finger	62	17
29. Loss of fingers accompanied by injuries of other fingers of the same hand, left	637	172
30. Loss of fingers accompanied by injuries of other fingers of the same hand, right	638	173
31. Loss of one leg	475	129
32. Loss of both legs	11	3
33. Loss of toes	209	57
34. Loss of one eye	1,718	465
35. Loss of one eye with injury to the other	228	62
36. Loss of both eyes	51	14
Total dismemberments	8,577	2,323

Permanent Total Disability.

Specific provisions for compensation of cases of permanent total disability are found in many compensation acts differing materially from provisions for permanent partial disability. In many states life pensions are granted for the permanent total cases where only temporary limited benefits are given for permanent partial disability. While cases of this nature are few, the cost must be a material factor as compared with the total cost of compensation. Therefore, some estimate as to the probable number of such cases becomes necessary.

Here foreign material must be used with extreme care because it is a condition largely depending upon the interpretation given to the term. In some cases there can be no difference of opinion as to the existence of permanent total disability. In others, however, it will largely depend upon the liberality with which compensation acts are administered. No American data on the subject exist, and the European data show considerable fluctuations. The percentage of cases of permanent total disability in official reports fluctuate between .06 per cent. in Italy and 1.51 per cent. in Austria. To a large extent this difference, as already explained, is due to the differences in the definition of the word "accident," and the number of minor accidents excluded. To obtain a basis of comparison without the necessity of adjusting all figures to one uniform basis of an accident of over one day's duration, we have assumed as a measure the proportion of cases of total permanent disability to 100 fatal accidents with the following results:

NUMBER OF CASES OF PERMANENT TOTAL DISABILITY PER 100 FATAL ACCIDENTS.

Austria	28.5
Germany	14.7
Russia	12.8
France	8.4
Italy	7.5

These differences are not to be explained by physical conditions only. We find that the Austrian interpretation of the definition of permanent total disability is the most liberal of all and almost twice as liberal even as that of Germany. Averaging the proportions in the five countries, we obtain 14.38 cases of permanent total disability per 100 fatal accidents, which is about one half of the proportion in Austria alone.

However, in view of the excessive ratio shown in Austria as compared with other countries, the average for the five seems to be preferable, and this indicates 14.4 cases of permanent total disability per 100 fatal accidents. On an assumption of 932 fatalities per 100,000 accidents, we get 133 cases of permanent total disability. As against this figure we have already included 14 cases of loss of both eyes and 3 cases of loss of both

legs in the dismemberment schedule. We have also assumed 62 cases of loss of one eye with injury to the other, 10 per cent. of which, or 6 cases, constitute permanent total disability according to the Austrian experience, so that 23 cases of permanent total disability are already included in the dismemberment schedule, and cases of permanent total disability not dismemberments are therefore reduced to 110.

Permanent Disability Other than Dismemberment.

This group of injuries presents perhaps the greatest difficulty in the effort to construct our standard accident table. Permanent reduction in the earning capacity of the injured workman, which does not necessarily destroy his economic usefulness entirely, but puts him down in the economic scale, frequently follows the class of injuries described above as dismemberment. It is evident that a man with one arm is worth less in the labor market than he was while both arms were intact. But permanent partial disability is not at all limited to such self-evident cases. Unhealed fractures, badly reduced dislocations resulting in loose joints, stiff joints, partial paralysis, ruptures, and many similar cases may have the same economic effect as loss of part of body. Because dismemberments have been made subjects of special regulation in most acts, it becomes necessary to separate those from other cases of permanent partial disability. Unfortunately, in a good many American acts, and still more in the administration of compensation laws in a good many American states, this condition of permanent partial disability due to other causes than dismemberment is not yet always sufficiently well recognized.*

Perhaps for this reason it is useless to expect any accurate reports of such cases in the early statistics of compensation in

*An interesting illustration of this may be found in the report of the Michigan Industrial Accident Board as to accidents occurring between December 1, 1913, and May 31, 1914, as published in the *National Compensation Journal* for June, 1914. The first table of this report is entitled: "Accidents causing permanent partial disability classified by part of body affected," and in this table are listed 318 accidents, every one of which is a case of dismemberment. It seems that the Michigan Industrial Board was absolutely unaware of the existence of these cases of permanent partial disability which are not due to dismemberment, and yet it is quite evident that a large number of such cases must have occurred. They are not self-evident at the time the accident has happened. In a great many of such cases a long time may elapse before the permanent nature will be realized.

this country, but it must not be assumed that because American statistics have not recorded such cases, they do not occur in actual practice. Undoubtedly, they have been handled in each state as cases of temporary disability until the permanent character has been established. Undoubtedly, also, in a good many cases the reduction in earning capacity if not excessive has been and is being disregarded. It is known, however, that there have been such cases in the state of Massachusetts. The first report of the Industrial Accident Board indicates on page 324 that there have been 1,457 cases of permanent partial disability though the number of dismemberments as stated on page 19 is only 967, leaving 490 cases of permanent partial disability not dismemberments, or about 50 per cent. as many as dismemberments. Again, in the first report of the Industrial Accident Board of California covering the period from September 1, 1911, to December 31, 1912, we find an analysis of 9,627 accidents, of which 412 were fatal and 534 resulted in permanent disability, and of the latter only 79 cases or about 15 per cent. are cases of permanent injury not due to dismemberment. In the state of Washington for the first year of operation of the act there have been 685 cases of permanent disability against 279 fatal accidents, the proportion being so high that it was quite probable that a large number of cases not dismemberments have been included.

But while their existence is being recognized, comparatively few of them are as yet recorded. It is necessary, therefore, to turn to European data to get a better conception of their importance and value. As already indicated, a comparison of statistics of various countries is somewhat vitiated by the differences in the definition of an accident, and since the reduction of all the statistical data to one basis of accidents of one day's duration is a rather difficult undertaking, the method of comparing them with the fatal accidents offers a more convenient shortcut.

The following table shows a degree of variation in this proportion among various European countries:

PERMANENT DISABILITY CASES IN PROPORTION TO FATAL ACCIDENTS.

Countries.	Years.	Number of Fatal Accidents.	Number of Accidents Resulting in Permanent Disability.	Ratio to Fatal Accidents.
Austria	1897–1906	8,349	82,446	9.9
Belgium	1905–1908	1,838	8,204	4.6
Denmark	1899–1906	389	4,192	10.8
France	1899–1908	18,708	140,877	7.5
Germany	1899–1908	59,893	313,219	5.2
Italy	1898–1902	2,224	9,701	4.4
Norway	1895–1905	832	4,496	5.4
Russia	1904–1906	2,345	34,981	14.9
		84,578	598,116	7.1

The ratio of permanent disability cases to fatal accidents seems to vary from 4.4 in Italy to 14.9 in Russia, the average being 7.1. The ratio seems to be fairly uniform in four or five countries such as Belgium, Italy, Germany, and Norway, being about 5 per cent., but rises to 10 per cent. or over in Austria, Denmark, and Russia. The variations are evidently significant of differences in the matter of judgment and decision in regard to individual cases rather than of bare physical facts. For all of these countries except Austria all cases of permanent partial disability, including those resulting from dismemberment, are stated together. Since the dismemberment cases have already been treated in a different way, it is necessary to obtain information as to the number of other cases, and for this Austria alone offers statistical data. Because of this accidental advantage of Austrian figures over all others, they have been used very largely by the New York State Insurance Department in its work of determining a differential between the cost of compensation under the New York and the Massachusetts compensation acts, and the use of these Austrian figures was very violently contested. The difficulty cannot be denied that Austrian statistics indicate twice as large a number of cases of permanent disability as most other countries. A careful inspection of the Austrian tables as re-published in the twenty-fourth Annual Report of the Commissioner of Labor does raise serious doubts as to whether such liberality of interpretation may be expected in any of the states for the first five or ten years, especially since it is twice as high as in

Germany. Even in Austria the proportion of such cases has been regularly increasing. Thus, in 1897 the proportion of permanent disability cases to fatal accidents was 8 to 1; in 1900, 9.8 to 1; and in 1906, 11.5 to 1.

We feel safe, therefore, in assuming that for the next few years at least, five cases of permanent partial disability against one fatal accident will be nearer the actual conditions than the proportion obtaining in Austria now. In other words, we may safely reduce the number of permanent partial cases as indicated by Austrian figures by 50 per cent.

In our table we have assumed 932 fatal accidents which would make the total number of permanent disability cases 4,660. The number of dismemberments we found to be 2,323 per 100,000. As a matter of fact, Austrian statistics indicate that out of a total of 8,579 cases of dismemberments 795, or 9.3 per cent., were so slight that even in Austria they were not considered as cases of permanent disability. Subtracting this 9.3 per cent. from the 2,323 cases, we have 2,108 cases of dismemberments per 100,000 leading to permanent partial disability. Subtracting this number from the total assumed number of permanent disability cases, we get 2,552 cases of permanent disability not due to dismemberments. Of these, as indicated earlier, 110 are cases of permanent total disability, leaving 2,442 cases of partial permanent disability not due to dismemberment.

Degree of Permanent Partial Disability.

The next question that requires investigation is the distribution of these cases according to degree of disability, upon which compensation depends. Here again we must draw entirely upon European data, and this again is a matter of judgment largely and everything depends upon the customary method of adjusting such cases. It is reasonable, therefore, to expect a very wide difference between results in different countries.

When an effort is made to compare information on this point as given in the reports of different countries, an additional difficulty arises from the fact that the sub-groupings in different countries are not uniform. Thus, for instance, in

German statistics the permanent disability cases are divided into only four groups: Under 25 per cent. disability, between 25 per cent. and 50 per cent., between 50 per cent. and 75 per cent., and between 75 per cent. and 100 per cent. Italian reports contain ten groups, one for each 10 per cent. of disability, while Austria has a division into seven groups on an entirely different basis. Finally, the third difficulty consists in the fact that in all countries except Austria all cases of permanent disability are lumped together whether due to dismemberment or not. It is reasonable to assume that the degree of disability due to dismemberment is often more serious than that due to other causes. In view of the specific provisions for dismemberments, it is necessary to eliminate these from the cases of permanent disability, but the only country for which this is feasible is Austria.

In the following table is shown the distribution of all cases of permanent disability in Austria according to the degree of disability. Similar data are given also for cases of dismemberment as well as for all cases of permanent disability other than dismemberment.

The first column indicates the rate of benefit in percentage of wages, which is the method of classification used in Austrian sources. The second column states the degree of disability covered by the rate of benefit, the Austrian law granting 60 per cent. of the loss of earning power.

The actual number of cases in 1891 to 1901 is shown in column 3, and the percentage distribution in column 4. A computation of the average degree of disability is made in columns 5 and 6 on an assumption that the mean of the two limits is the average degree of disability for each group. The last column shows the results of this computation. As was to be expected, dismemberments lead to higher degrees of disability. This is well shown by the percentage column as well as by the average computed.

The average degree of disability for dismemberments is 43.1, and for all other cases 29.1. But since there are numerically a great many more cases of permanent disability in Austria not due to dismemberments, the average degree of disability for all cases (32.1) is only slightly affected by the higher degree of disability of the dismemberment cases.

AUSTRIA.

ALL CASES OF PERMANENT DISABILITY.

Rate of Benefit (Per Cent. of Wages).	Degree of Disability (Per Cent.).	Number of Cases.	Per Cent.	Average Degree of Disability.	Total Amount of Disability (Average Degree ×No. of Cases).	General Average.
5 or under	8 or under	3,629	9.8	4	14,516	
6–11	9–18	11,707	31.7	13	152,191	
12–19	19–32	7,126	19.4	25	178,150	
20–29	33–48	5,760	15.6	40	230,400	
30–39	49–65	3,487	9.4	50	195,272	
40–50	66–83	4,098	11.1	74	303,252	
60	100	1,104	3.0	100	110,400	
		36,911	100.0		1,184,181	32.1
DISMEMBERMENT.						
5 or under	8 or under	603	7.7	4	2,412	
6–11	9–18	1,323	17.0	13	17,199	
12–19	19–32	1,090	14.0	25	27,250	
20–29	33–48	1,789	23.0	40	71,560	
30–39	49–65	778	10.0	50	43,568	
40–50	66–83	1,722	22.1	74	127,428	
60	100	479	6.2	100	47,900	
		7,784	100.0		337,317	43.1
ALL OTHER.						
5 or under	8 or under	3,026	10.4	4	12,104	
6–11	9–18	10,384	35.7	13	134,992	
12–19	19–32	6,036	20.7	25	150,900	
20–29	33–48	3,971	13.6	40	158,840	
30–39	49–65	2,709	9.3	50	151,704	
40–50	66–83	2,376	8.2	74	175,824	
60	100	625	2.1	100	62,500	
		29,127	100.0		846,864	29.1

The fact that Austria shows four times as many cases of permanent disability other than dismemberments makes the use of Austrian data subject to criticism. The same liberality which leads in Austria to a recognition of permanent partial disability where such would be denied in other countries may also lead to adjustments in favor of higher degrees of disability than would be the case in other countries. Of course, since we are dealing here not with the number of cases of partial disability but only with their distribution according to degree, these two tendencies mentioned may actually counteract each other, that is, if on one hand the tendency to allow larger degrees of disability than would other countries, would disturb

the percentage series by making the higher groups heavier than they should be, then, on the other hand the tendency to recognize light degrees of permanent partial disability, where in other countries no permanent results would be claimed, would have the opposite tendency of loading the lower groups of the percentage series. In any case, we think it is safer to check up the results of Austrian experience by that of other countries.

The following statements are given with similar computations for Denmark, Italy, and Germany:

DENMARK (1899–1908).

Degree of Disability (Per Cent.).	Number of Cases.	Per Cent.	Average Degree of Disability in Group.	Total Amount of Disability (Average Degree ×No. of Cases).	Average Degree of Disability all Cases (Per Cent.).
5	300	7.2	3	1,500	
6–10	1,400	33.4	8	10,400	
11–20	1,384	33.0	15	20,700	
21–25	265	6.4	23	5,995	
26–50	658	15.6	38	25,004	
51–100	185	4.4	70	12,950	
	4,192	100.0		76,609	18.3

ITALY (1902).

1–4	6	.22	2.5	15	
5–10	1,157	42.10	7.5	8,678	
11–20	576	20.96	15.5	8,928	
21–30	330	12.01	25.5	8,415	
31–40	318	11.57	35.5	11,289	
41–50	130	4.73	45.5	5,915	
51–60	63	2.29	55.5	3,497	
61–70	74	2.69	65.5	4,847	
71–80	62	2.26	75.5	4,681	
100	32	1.16	100.0	3,200	
	2,748	100.00		59,465	21.6

GERMANY (1896–1903).

25 or under	34.88	65.3	15	979.5	
25–50	12.17	22.8	35	798.0	
50–75	4.02	7.5	60	450.0	
75–90	1.18	2.2	85	187.0	
100	1.18	2.2	100	220.0	
	53.43	100.0		2634.5	26.3

The average degree of disability in cases of permanent disability in the different countries appears to be as follows:

	Per Cent.
Denmark, all cases	18.3
Italy, all cases	21.6
Germany, all cases	26.3
Austria, dismemberments	43.1
Austria, not dismemberments	29.1
Austria, all cases	32.1

This difference, like the one in regard to the number of cases of permanent disability, is probably one of judgment rather than of physical facts, and the best method, therefore, appears to be to obtain an average of the data in the various countries so as to get a picture of the average conditions in Europe. Austria was found to be more liberal in determining the number of cases of permanent partial disability, and the same liberality appears in the matter of judgment of the degree of disability, but if Austria seems to be too liberal in these respects, it is probable that the decisions in Denmark, showing nearly 75 per cent. of such cases with less than a 20 per cent. degree of disability, are less liberal than they would be in this country. The tendency of decisions in regard to such cases in this country, where the question comes up at all, would be towards fairly liberal allowances. It is often argued that these results in Germany and in Austria have come only after a long period of experience with compensation, after the training of workmen in malingery, etc. As a matter of fact, the rule works also in an opposite direction. There has been in Germany recently a very strong tendency towards very much stricter decisions as to the degree of disability than in the beginning of the compensation experience. In the absence of any other basis for judgment, we feel that as far as the question of degree of disability is concerned, we are conservative in assuming that adjustments in this country will on the average be as favorable to the injured as they are in Europe.

It was, therefore, decided to average the data for Austria and Italy and Germany. The Danish series was discarded because of the small exposure and its rather unsatisfactory

arrangement. In averaging the other three countries the difficulty was met of groupings not uniformly arranged. To overcome this the following method was used:

For each country a diagram was drawn indicating the percentage distribution within each given interval by an area of a rectangle, having that interval for a base. Then perpendicular lines were drawn at each ten per cent. and the area of each ten per cent. group was computed. While this method is somewhat crude, it does introduce a substantial correction and gives results which appear fairly satisfactory. In the following table the distribution of cases of permanent disability in these three countries is shown, so adjusted as to give the data for groups ending with ten per cent.

DISTRIBUTION OF CASES OF PERMANENT PARTIAL DISABILITY BY DEGREE OF DISABILITY, AUSTRIA, ITALY, AND GERMANY.

	Austria.				
Per Cent. of Disability.	Dismemberment (Per Cent. of Cases).	All Other (Per Cent. of Cases).	All Cases (Per Cent. of Cases).	Italy (Per Cent. of Cases).	Germany (Per Cent. of Cases).
0–10	11.1	17.5	16.1	42.3	19.1
11–20	15.6	31.5	28.0	20.9	33.2
21–30	10.0	14.8	13.9	12.0	17.6
31–40	13.5	9.8	10.6	11.6	9.9
41–50	12.7	7.9	8.9	4.7	8.4
51–60	5.9	5.5	5.5	2.3	2.9
61–70	9.1	5.0	5.9	2.7	3.1
71–80	12.3	4.6	6.2	2.3	2.2
81–90	3.6	1.3	1.9	.....	1.4
91–100	6.2	2.1	3.0	1.2	2.2
	100.0	100.0	100.0	100.0	100.0

To obtain an average for these three countries only one column was taken for Austria, namely, that giving the distribution for cases other than dismemberments. The averages obtained and the application of these percentages to 2,552 cases are shown in the following table:

Degree of Disability.	Percentage of Cases.	Number of Cases per 100,000.
0–10	26.3	672
11–20	28.6	728
21–30	14.8	378
31–40	10.4	265
41–50	7.0	179
51–60	3.6	92
61–70	3.6	92
71–80	3.0	77
81–90	.9	23
91–100	1.8	46
		2,552

By an independent method we have already determined the cases of permanent total disability to equal 110 (exclusive of dismemberments). As a matter of fact there are very few (and in some countries no) judgments of degree of disability over 80 per cent. because when disability reaches that limit it is practically recognized as total disability on account of the impossibility of obtaining employment. Therefore, to avoid duplications we exclude all the cases of the last two sub-groups and also reduce group 70–80 by 41, leaving in that group only 36 cases so as to balance the figure up to 2,442 cases of permanent partial disability not due to dismemberment.

Temporary Disability.

To arrive at the number of these cases it is only necessary to subtract all cases already determined from 100,000 as follows:

Fatal accidents	932
Dismemberments	2,323
Permanent total disability not dismemberments	110
Permanent partial disability not dismemberments	2,442
Total serious accidents	5,807
Temporary disability only	94,193
Total	100,000

In connection with this class of injuries the important question is that of duration of disability. In regard to this the largest volume of American experience is contained in the first report of the Massachusetts Industrial Accident Board, where 89,694 accidents are distributed as follows:

Under 2 weeks	68,586
2–4 weeks	10,568
4–8 weeks	6,638
8–13 weeks	2,355
13–26 weeks	1,275
Over 26 weeks	272
Total	89,694

It would be preferable to use American data such as those quoted above, but unfortunately these figures are deficient for several reasons. First, accident notices, irrespective of duration, have been included which give an abnormally high number of cases under two weeks. Second, the sub-groupings are not sufficiently detailed. In utilizing these figures for the computations of the New York differential, the New York State Insurance Department was forced to assume that the average duration in each group was the mean of the limits, three weeks for the group from two to four weeks, six weeks for the group from four to eight weeks, etc. As the number of cases in each group rapidly declines the average is probably much nearer the lower limit than the mean, and where the margin between the limits is so great a considerable error is introduced thereby. Third, the Massachusetts report seems to divide all the cases into two groups, fatal and those of temporary disability. It is evident that the series quoted above contain all the cases which eventually lead to permanent disability. Even dismemberments are included in that series, the duration meaning that of total disability irrespective of the subsequent partial disability. The result of this is to make a very much higher percentage of accidents of longer duration.

Fortunately a much better series of figures for this purpose is available in the twenty-fourth Annual Report of the United States Commissioner of Labor, namely, the data in regard to

accidents in Russia for a three-year period, 1904 to 1906, where the distribution is given by weekly periods up to thirteen weeks and where the temporary and the permanent cases are separately analyzed. The fact that these figures appertain to Russian conditions need not disqualify them in view of the general theory underlying the standard table.

There is one difficulty about this series: The accidents of under four days' duration are not reported. This makes the total of accidents seven days or under too small. This, however, can be corrected as explained presently. To determine whether the use of these Russian statistics is justifiable, they were subjected to a test to find out how far they are comparable with the Massachusetts figures on general lines. In order to make such a comparison possible, 41 per cent. of notices, relating to accidents of under one day's duration, were taken out of the Massachusetts series. These notices, amounting to 36,774, were deducted both from the total and from the number of accidents of under two weeks' duration, thus obtaining for Massachusetts the following corrected series:

Period of Disability.	Number.	Per Cent.
Less than 2 weeks	31,812	60.1
2–4 weeks	10,568	20.0
4–8 weeks	6,638	12.5
8–13 weeks	2,355	4.5
13–26 weeks	1,275	2.4
Over 26 weeks	272	.5
Total	52,920	100.0

Distributing 153,843 non-fatal accidents, occurring in Russia, 1904–1906, in the same large groups, we get the following results:

Period of Disability.	Number.	Per Cent.
Under 2 weeks	79,577	51.7
2–4 weeks	33,776	22.0
4–8 weeks	23,164	15.0
8–13 weeks	10,144	6.6
Over 13 weeks	7,182	4.7
Total	153,843	100.0

A comparison of these two series indicates a smaller percentage of disability of under two weeks and a larger percentage of accidents in all other groups in Russia as compared with Massachusetts, but this evidently is due to the omission of accidents resulting in disability of under four days' duration in the Russian statistics. This has been corrected in the following manner. The Massachusetts data indicate that there are three times as many cases in the first group, from one day to two weeks, as there are in the second, from two to four weeks. That would make the number of accidents in the under two weeks group in the Russian series 101,328 instead of 79,577, or an increase of 21,751. This correction must also be made in the total, which increases from 153,843 to 175,596. After this correction the similarity of the percentage distribution in both series becomes very much greater, as is shown in the following comparison:

Period of Disability.	Russia Per Cent.	Massachusetts Per Cent.
Under 2 weeks	57.6	60.1
2–4 weeks	19.3	20.0
4–8 weeks	13.2	12.5
8–13 weeks	5.8	4.5
Over 13 weeks	4.1	2.9
	100.0	100.0

A slight difference between the two series still remains indicating longer periods of duration in Russian statistics. This may be easily explained by the fact that some of the Massachusetts information is premature because in a good many cases the period of disability was unterminated at the time the statistical data were collected. In further support of these figures we may quote an experience of over 20,000 accidents to United States Government employees, 1908–1911, indicating the following distribution:

Period of Disability.	Per Cent.
Under 2 weeks	55.1
2–4 weeks	20.2
4–8 weeks	14.0
8–13 weeks	4.5
Over 13 weeks	5.1

While these comparisons prove that the Russian statistical data are quite applicable to American experience and therefore may be used here, further refinement becomes necessary. The figures as quoted include both temporary and permanent cases, but the treatment of permanent cases, especially dismemberment, in many state laws differs. In several states, for instance, it is specifically provided that the so-called specific dismemberment benefits should be exclusive of all other benefits. In other states, on the contrary, both temporary total disability benefit and dismemberment benefit may be made in the same cases. It becomes necessary, therefore, to separate these two groups of accidents and to construct a separate series of distribution by duration for the temporary injuries and also for the temporary disability period of permanent injuries. It is quite evident that in serious dismemberments or other accidents leading to permanent disability of a partial character, the initial stage of total disability will on an average be very much longer than in cases which leave no permanent results. As already stated such a separation is possible by means of Russian statistics, which is an additional argument for their use here.

DURATION OF DISABILITY IN TEMPORARY DISABILITY CASES ONLY. RUSSIA (1904-1906).

Duration.	Number of Cases in Russia.	Per Cent.	Computed Number of Cases for the Standard Table.
1–7 days	59,925*	39.5	37,113
8–14 "	38,667	25.5	23,925
15–21 "	19,551	13.2	12,433
22–28 "	11,272	7.4	6,970
29–35 "	7,167	4.7	4,427
36–42 "	4,335	2.9	2,732
43–49 "	2,812	1.8	1,695
50–56 "	1,897	1.2	1,130
57–63 "	1,483	1.0	942
64–70 "	944	.6	565
71–77 "	715	.5	471
78–84 "	571	.4	377
85–91 "	459	.3	283
92–182 "	1,492	1.0	933
Over 182 days	345	.2	197
Total.....	151,635*	100.0	94,193

*21,751 accidents were added to the group "1–7 days" and to the total, so as to adjust it to our standard basis. In the last column the numbers have been re-computed on a basis of a total of 94,193, as assumed in the standard series.

The Russian classification does not go beyond 13 weeks, throwing all the cases over that period into one group. The number of such cases was 1,897, or in the standard series 1,130. It was more convenient to distribute these 1,130 cases in the two groups, 13–26 weeks and over 26, in proportion to the similar distribution in Massachusetts (in percentages of 81.2 and 18.8). The groups above are so narrow that the average duration of an injury in each group can easily be assumed as the mean between the limits because those are confined within one week. This, however, does not apply to the last two groups. The Russian sources indicate not only the number of cases in the group, but also the total number of the days of disability. The average duration of disability in the last group over thirteen weeks was 137 days or 19.5 weeks, which is just the mean between 13 and 26, so that for all practical purposes this figure may be accepted for the last two groups.

The Standard Table.

The above analysis completes the distribution of 100,000 accidents according to their results as far as disability is concerned. The table may be given here as a whole:

STANDARD DISTRIBUTION OF ACCIDENTS TABLE.

Fatal cases		932	
Dismemberments		2,323	
1. Loss of left arm	64		
2. Loss of right arm	95		
3. Loss of left hand	50		
4. Loss of right hand	61		
5. Loss of left thumb	29		
6. Loss of right thumb	30		
7. Loss of left index	59		
8. Loss of right index	69		
9. Loss of left middle finger	26		
10. Loss of right middle finger	31		
11. Loss of left ring finger	14		
12. Loss of right ring finger	17		
13. Loss of left little finger	32		
14. Loss of right little finger	34		
15. Loss of thumb and one or more fingers, left hand	14		
16. Loss of thumb and one or more fingers, right hand	17		
17. Loss of two or more fingers, left hand	63		
18. Loss of two or more fingers, right hand	66		
19. Loss of one phalange of left thumb	55		
20. Loss of one phalange of right thumb	62		
21. Loss of phalange of left index	83		
22. Loss of phalange of left middle finger	52		
23. Loss of phalange of right index	93		
24. Loss of phalange of right middle finger	53		
25. Loss of phalange of ring finger, left hand	25		
26. Loss of phalange of ring finger, right hand	19		
27. Loss of phalange of left little finger	18		
28. Loss of phalange of right little finger	17		
29. Loss of fingers accompanied by injuries of other fingers, left hand	172		
30. Loss of fingers accompanied by injuries of other fingers, right hand	173		
31. Loss of one leg	129		
32. Loss of both legs	3		
33. Loss of toes	57		
34. Loss of one eye	465		
35. Loss of one eye with injury to the other	62		
36. Loss of both eyes	14		
Permanent total disability other than dismemberments		110	
Permanent partial disability other than dismemberments		2,442	
Leading to Disability of			
1–10 Per Cent	672		
11–20 " "	728		
21–30 " "	378		
31–40 " "	265		
41–50 " "	179		
51–60 " "	92		
61–70 " "	92		
71–80 " "	36		
Temporary disability		94,193	
Not over 1 week	37,113		
1– 2 weeks	23,925		
2– 3 "	12,433		
3– 4 "	6,970		
4– 5 "	4,427		
5– 6 "	2,732		
6– 7 "	1,695		
7– 8 "	1,130		
8– 9 "	942		
9–10 "	565		
10–11 "	471		
11–12 "	377		
12–13 "	288		
13–26 "	933		
Over 26 weeks	197		
Total			100,000

The claims made for this table must not be misunderstood. It cannot be assumed for a moment that any 100,000 accidents occurring in this country will comply absolutely in their distribution with the proportions indicated in the table. Undoubtedly, accidental variations may occur, and, furthermore, a certain essential difference between conditions in this country and those assumed in the construction of the table may eventually develop when actual experience has been compiled. The claim is made, however, that the cost of any 100,000 cases will not vary greatly from the cost of the accidents distributed in the Standard Table, and another claim may be made for the table still more emphatically, that even if the actual cost of 100,000 accidents may differ, the table is sufficiently accurate for the purpose for which it was constructed, namely, to enable us to measure the differences between compensation acts, because it is, after all, not the absolute cost but only the comparison of costs that we are trying to arrive at. In that respect some similarity may be indicated between this standard accident table and mortality tables. Not even the largest life insurance company would expect the actual deaths to comply absolutely with the mortality table even if the latter were ideally correct. When computed by independent age groups, the profits and losses in the various groups will probably fluctuate from year to year, but all of these fluctuations do not interfere with the reliability of the mortality table as a whole. The vast amount of experience in compensation insurance which will undoubtedly accumulate in this country within a very few years, will enable us to reconstruct this table, but the method of its application will not be changed thereby.

Temporary Total Disability in Permanent Cases.

While the entire distribution of 100,000 accidents has been accomplished, there are several additional factors which must be taken into consideration and must be studied statistically. The first is the determination of the periods of total disability which accompany cases of dismemberment and of permanent partial disability not dismemberment. For reasons indicated above, this must be computed separately because this addi-

tional liability is not recognized in all compensation acts. The standard distribution according to duration as given above will not apply because the average nature of these injuries is very much more severe and the period of recovery longer. The Russian figures are the only ones which furnish information on this point. In the following table the 2,442 cases of permanent partial disability and the 2,323 cases of dismemberments are distributed according to the duration of total temporary disability applying to both groups the same percentage distribution ascertained from Russian statistics. The two groups of accidents are distributed here separately, because in some states dismemberments are excluded and then only the column for permanent partial disability must be used, while in others the total column may be applied.

Period of Disability.	Per Cent.	Number of cases.		
		Permanent Partial Disability.	Dismember-ment.	Total.
Under 1 week	5.7	139	132	271
1–2	5.6	137	130	267
2–3	5.9	144	137	281
3–4	6.5	159	152	311
4–5	7.8	190	181	371
5–6	7.5	183	174	357
6–7	7.0	171	163	334
7–8	6.6	161	153	314
8–9	6.9	168	160	328
9–10	5.2	127	121	248
10–11	4.7	115	109	224
11–12	4.3	105	100	205
12–13	4.0	98	93	191
13 and over	22.3	545	518	1,063
	100.0	2,442	2,323	4,765

Dependency in Fatal Accident Cases.

The number of fatal accidents per hundred thousand was determined in the standard series as 932, but the correct valuation of their cost requires a good deal of additional statistical information. In regard to the number and status of the dependents, the laws differ very much. In some cases specific groups of dependents are provided for by definite proportions, and in such cases it becomes necessary to determine the number of such dependents who may be expected to survive. In

other states all dependents are given the same rights except as to the distinction between total and partial dependents, although in most cases certain relatives are designated as total dependents. As in all cases widows and orphans, under a certain age, are recognized as total dependents, the first important fact that must be ascertained is the conjugal distribution of victims of fatal accidents. In regard to this question a very useful table is found in the report of the Washington Industrial Accident Commission for 1912, where the conjugal condition of all injured employees is given, indicating 3,351 single and 3,005 married. No data are given for widows or divorced persons, and a letter of inquiry to the Commission brought the reply that widowed persons without children were classified with the single and widowed with children with the married persons. The proportion, however, of single men in the state of Washington appears unusually high, nearly 53 per cent., and it may be explained by the character of population and industry in a frontier state, but it will be utterly inapplicable to older settled communities.

In France for the period 1898–1905 insurance companies reported 9,055 fatal accidents* distributed according to conjugal condition as follows:

	Number.	Per Cent.
Single	3,057	33.8
Married	5,266	58.1
Widowed	578	6.4
Unknown	154	1.7
Total	9,055	100.0

French experience indicates, therefore, that little over one third of the persons fatally injured are single. In Germany† there were 68 widows for each 100 fatal accidents reported to the Industrial Accident Associations, which is a somewhat higher ratio than in France, and may be easily explained by the comparatively higher marriage rate of Germany.

It seems safer for this country to assume the general proportion of married and unmarried people among the male working

* Twenty-fourth Annual Report, United States Bureau of Labor, p. 704.
† *Ibid.*, p. 1154.

population. The figures are taken only for the male population because the percentage of married persons is much higher for the female population, while the number of fatal accidents to women is extremely small and therefore can be disregarded.

Taking the entire male population of the country over 20 years of age, their distribution by conjugal condition is as follows:

Single	29.1 Per Cent.
Married	64.6 Per Cent.
Widowed	5.3 Per Cent.
Divorced	.6 Per Cent.
Unknown	.4 Per Cent.
Total	100.0 Per Cent.

The practical agreement of these United States Census figures with the results of special investigation of fatal accidents in France and Germany allows us to assume this as a basis for our standard table. For purposes of simplicity the unknown are thrown in with the single persons, and the divorced with the widows, so that the assumption is as follows:

Single persons	29.5 Per Cent.
Married persons	64.6 Per Cent.
Widowed persons	5.9 Per Cent.

which on the basis of 932 fatal accidents gives the following results:

Single persons	275
Married persons	602
Widowed persons	55
Total, fatal accidents	932

In a large number of states, as for instance Massachusetts, Kansas, Rhode Island, Nebraska, and others, the only point at issue in granting benefits for fatal accidents is that of existence of dependents, either total or partial, without any specific benefits being prescribed for specific classes of dependents. In such cases the assumption is justified that in all cases where victims of accidents were married there are total dependents, and as far as the widowers are concerned, while there may be

a few cases where no orphans survive, yet they would be the exception, and in absence of definite information it was assumed that for the widowed as well as married total dependents existed in every case, which gives 657 cases with total dependency. In addition to that there must be a certain number of the single fatally injured who leave dependents, either total or partial.

For the distribution of the total accidents to single persons in regard to existence of dependency, some French data have been used. They indicate that out of 3,057 single persons fatally injured in France, 2,179, or 71.39 per cent., left no dependents under the French act. The statistics of dependency in the state of Washington have already been referred to. It was pointed out that the proportion between single and married persons in the state of Washington would be exceptional from that characteristic of other states. The data in regard to the number of dependents for each one of the two groups need not be disqualified from use. As reference to that table will show, out of 3,351 single employees injured, 2,457, or 73.3 per cent., have no dependents at all.

The higher percentage in the state of Washington may easily be explained by the larger proportion of young men without any relatives in the state, due to the transitory condition of the population, but the difference between the Washington and the French proportion is so slight that evidently we are dealing here with a fairly uniform relationship. We have, therefore, assumed that some 71 per cent. of the single persons fatally injured leave no dependents at all, or 195 cases out of the 275 fatal accidents to unmarried employees, or 932 fatal accidents.

The final question requiring an answer is that of distribution of the remaining 80 cases according to the number leaving total dependents and that leaving partial dependents only. It proved impossible to obtain any statistics on this point. The Washington figures used here do not show it. The Massachusetts report for the year 1912–13 shows the existence of 103 partial dependents for the 470 fatal accidents, but it does not indicate the number of cases to which these 103 partial dependents belong, nor in how many cases these partial dependents

were the only dependents. The Washington figures indicate that in the case of single persons fatally injured who leave any dependents at all, the average number of dependents is nearly 2, which would indicate that there were in the state of Massachusetts about 50 cases of partial dependency. However, there is no evidence that the partial dependents recorded were the only dependents in the respective cases. In recognizing the economic motive which would influence people to claim total dependency in all possible cases and the difficulty which must frequently arise in disproving such claims, we have assumed somewhat arbitrarily that in about 60 per cent. of the cases of fatal injuries to single employees leaving any dependents at all, the dependency would be recognized as total, and in 40 per cent. only partial dependence would exist, which makes the total number of cases with total dependents 48, and the number of cases with partial dependents 32. The final result of this analysis, therefore, is an assumption that the 932 cases will be divided according to dependency as follows:

Total dependents	705
Married	602
Widowed	55
Single	48
Partial dependents	32
No dependents	195
Total	932

Number of Dependents.

In a few of the states having compensation acts at present the provisions for fatal accidents are somewhat more complicated. Specific benefits may be granted either according to the number of dependents surviving, or with an even greater effort at economic justice, according to the class or rather degree of relationship and number of dependents surviving. This is particularly true of the states of New Jersey, Minnesota, and New York, and similar provisions may be expected to become more numerous in the future. Therefore, it became necessary to obtain some data concerning the number of dependents surviving. Moreover, it is not always sufficient

to know the total number of dependents surviving for the entire number of fatal accidents, but rather the distribution of cases according to the number surviving in each particular case. Unfortunately, our Census statistics on the size of families are not in such condition as to make the data available for our purposes. The best information that is as yet available has been collected by the Washington Industrial Accident Commission in its report for 1912, giving the distribution of all persons injured whether fatally or not according to class and number of dependents.

DEPENDENTS OF EMPLOYEES INJURED IN THE STATE OF WASHINGTON, 1912.

	Single Persons.	Number of Cases.	Number of Dependents.
1.	Single and no dependents	2,457	—
2.	" " 1 "	440	440
3.	" " 2 "	338	676
4.	" " 3 "	49	147
5.	" " 4 "	32	128
6.	" " 5 "	13	65
7.	" " more than 5 dependents	22	132
		3,351	1,588

	Married Persons.	Number of Cases.	Number of Dependents.	Number of Children.
1.	Married and no children	800	800	—
2.	" " 1 "	628	1,256	628
3.	" " 2 "	556	1,668	1,112
4.	" " 3 "	356	1,424	1,068
5.	" " 4 "	196	980	784
6.	" " 5 "	111	666	555
7.	" " 6 "	43	301	258
8.	" " 7 "	14	112	98
9.	" " 8 "	3	27	24
10.	" " 9 "	1	10	9
11.	" no children, 1 other dependent	83	166	—
12.	" " 2 " dependents	19	57	—
13.	" " 3 " "	9	36	—
14.	" " 4 " "	1	5	—
15.	" " more than 4 dependents	1	6	—
16.	" 1 child, 1 other dependent	53	159	53
17.	" 2 children, 1 other dependent	35	140	70
18.	" 3 " 1 " "	26	130	78
19.	" 4 " 1 " "	16	96	64
20.	" 5 " 1 " "	4	28	20
21.	" more than 5 children, 1 dependent	5	40	30
22.	" 1 child, 2 dependents	13	52	13
23.	" 2 children, 2 dependents	12	60	24
24.	" 3 " 2 "	2	12	6
25.	" 4 " 2 "	3	21	12
26.	" 5 " 2 "	5	40	25
27.	" more than 5 children, 2 dependents	1	8	6
28.	" 1 child, 3 dependents	5	25	5
29.	" 1 " 4 "	3	18	3
30.	" 2 children, 4 dependents	1	7	2
		3,005	8,350	4,947

This table shows that in the 3,005 cases of married persons injured, there were altogether 8,350 dependents. Presumably there were 3,005 consorts and of the remaining 5,345 dependents, 4,947 were children and 398 other dependents, largely parents. The Washington law recognizes dependency of children up to the age of 16 only; presumably only children of that age were included in the table, showing 164.6 children under 16 per 100 parents.

This data must be subjected to some sort of a check to ascertain how far the Washington data are at all applicable to conditions throughout the country. The United Census States for 1910 indicates that there were in that year 31,320,334 children under 16, and that the number of males married, widowed, and divorced was 19,720,152, giving a proportion of 177 children under 16 per hundred married males. The excess of this average over that in the state of Washington may be easily explained by the fact that a certain number of children under 16 have no father living. The proportion, therefore, of 164.6 children per 100 fathers may be accepted as essentially correct. Where the law grants rights to children up to the age of 18, the number of surviving children will naturally be larger. Based upon the figures of the United States Census, the estimate is made that the number of children under 18 per 100 parents should be increased to 184.4.

Utilizing these averages for the definite number of fatal injuries assumed in our standard table, we have as follows:

	Number of Cases.	Number of Dependents.
Widows, in accidents to married employees	602	602
Orphans, in accidents to married or widowed employees	657	1,071
Other dependents, in accidents to married employees	657	87
Other dependents, in accidents to single employees	80	144
All cases, with dependents	737*	1,904

This indicates 258 dependents per 100 fatal accidents leaving dependents, or 205 per 100 fatal accidents. If, however, dependent children up to the age of 18 instead of 16 be taken into consideration, the number of dependent children will

* This total does not represent the addition of cases in the column because in the latter the cases were entered more than once.

increase to 1,210, and the total number of dependents to 2,044, or 277 per 100 fatal accidents leaving dependents, or 219 per 100 fatal accidents occurring, which shows a remarkably close approximation to the German figures of dependents surviving, though computed independently on a basis of Washington figures and certain United States Census data.

In a careful valuation of fatal accidents further information may be necessary in regard to the relationship of dependents other than widowed and children. While information on this subject is very limited, nevertheless some use may be made of the Washington figures. We find that in 3,005 cases of injuries, there were 8,350 dependents of whom presumably 3,005 were widows and 4,947 were children, leaving for other dependents 398. The number of cases in which such other dependents were ascertained is 297. Of these, 222 cases had only one dependent other than widow or children, 55 cases had two dependents other than wife or children, and only 20 cases had more than two dependents of this class, the total number of such dependents in the 20 cases being 71. The number of dependents, therefore, in excess of two was only 31. The assumption seems justified that where only one dependent other than wife or children exists, that may be assumed to be either aged father or mother, and other dependents, largely brothers or sisters, were very few, only 31 cases out of 3,005, or about 1 case in a hundred fatal accidents. That proportion appears to be strikingly low, but it must be remembered that in most cases where specific benefits are given, the share assigned to the widow, orphans, or parent, will be sufficiently large to absorb the entire maximum amount of compensation allowable, so that in only a very few cases would brothers and sisters actually be in a position to claim compensation independently.

As far as the dependents of single persons are concerned, we have the Washington data indicating about 180 dependents per 100 cases leaving dependents. We have the indication from the French statistics that the proportion is only 133 per 100 cases, but the French act does not cover other dependents except parents. We may assume, therefore, that of the 180 dependents per 100 cases, 133 represent parents, and 47 other

dependents, largely brothers and sisters. Applying this proportion to the 180 cases of single employees in which dependents are expected according to our assumption, we may assume 106 parents and 38 brothers and sisters as dependents of single persons fatally injured. On the basis of such assumptions the cost of the 932 fatal accidents may be fairly accurately computed.

Age of Injured and Dependents.

In most states compensation to dependents is given for a temporary period only. In such states it may be assumed that in the majority of cases, and especially when the period is short, the full amount will be paid even if one of the dependents happens to die during the period of compensation, because other dependents would probably arise to claim the benefit. Even there exceptions must be made in a case of widows surviving without other dependents, because in such cases the death of the widow may cause the payments of benefits to be discontinued altogether. Actuarially, we are dealing here with the cost of a temporary annuity where the element of mortality plays an important part. Still more important is the element of mortality in a case of benefits to children, or all cases where life benefits are granted by the compensation act. Many acts grant life benefits in permanent total disability cases, and at least one is certain to grant life pensions in all grave injuries (California), while in several other states (New York, Ohio, Kentucky, and Maryland) there is a possibility that life pensions may be granted under the law in all permanent partial injury cases. It is evident, therefore, that the question of age both of the injured persons and the dependents acquires an important value in computing cost of compensation. Various statistical sources must be utilized to obtain some information on this subject. The Massachusetts Industrial Accident Board's Report for 1912–13 states the ages of fatally injured persons, from which the following computation has been made:

AGES OF FATALLY INJURED.

	Number.	Average Age.	Aggregate Ages.
Under 16 years	4	15	60
16–21	18	18.5	333
21–30	135	25	3,375
30–40	113	35	3,955
40–50	83	45	3,735
50–60	66	55	3,630
Over 60	55	65	3,575
	474		18,663

The average age at death in fatal accidents appears to be about 39½ years in the state of Massachusetts. On the other hand, in Illinois, according to the 6th Report of the Bureau of Labor Statistics entitled Industrial Accidents in Illinois for 1912, the ages of the fatally injured are given as follows, indicating an average age of 35:

AGES OF FATALLY INJURED.

	Number.	Average age.	Aggregate ages.
Under 20 years	5	16	80
20–25	30	22.5	675
25–30	30	27.5	825
30–35	30	32.5	975
35–40	23	37.5	863
40–45	20	42.5	850
45–50	13	47.5	617
50–55	10	52.5	525
55–60	8	57.5	460
60 and over	4	65	260
	173		6,130

In the absence of more accurate information it seems advisable to assume one average age for all states for fatal injuries, which is approximately 37. In handling permanent partial disability cases, use was made of the information given by the Austrian statistics, which indicates that the average age increases with the degree of disability; or perhaps it would be more accurate to state that the degree of disability is affected by the average age, so that while for temporary cases and for cases of very light degree of permanent disability, the average age appeared to be 37, it rose to 39 where the degree of disability is over 50 per cent., and to 42 where the degree of disability was total, and computations were based upon these broad conclusions.

A very important question is the age of the widow rather than of the person fatally injured. Unfortunately, in this country there seems to be scarcely any information about the respective ages of consorts. The average age of the widows as given by the United States Census would evidently be of no advantage, because what must be ascertained here is the average age at which widowhood arises, while the Census deals with widows whose widowhood has arisen at different periods. An effort was made to utilize the statistics of the United States Census for this purpose, and the method is indicated here though perhaps the results should be utilized, if at all, with a great deal of caution.

In the following table taken from the Thirteenth Census for 1910 is shown the distribution of married males and married females according to age group. An average age for married males and females has been computed on the assumption that the average age for each group is equal to the mean of the limits of that group.

Age Groups.	Married Males (000's omitted).			Married Females (000's omitted).		
	Number.	Average Age.	Aggregate.	Number.	Average Age.	Aggregate.
15 to 19 yrs.....	52	17.5	910	513	16.5	8,978
20 " 24 "	1,100	22.5	24,750	2,225	22.5	50,063
25 " 29 "	2,353	27.5	64,708	2,823	27.5	77,633
30 " 34 "	2,611	32.5	84,858	2,620	32.5	85,150
35 " 44 "	4,873	39.0	190,047	4,410	39.0	171,990
45 " 54 "	3,659	49.0	179,291	2,904	49.0	142,296
55 " 64 "	2,113	59.0	124,667	1,480	59.0	87,320
65 and over.....	1,304	69.0	89,976	687	69.0	47,403
	18,065		759,207	17,662		670,833

The average age of married men appears to be 42, and the average age of married women 35. It cannot be assumed that these respective ages apply to the persons fatally injured and their widows, but it does seem to indicate that there is a certain relationship between the average ages of married men and married women. The possible errors are the inclusion of married males or females whose wives (respectively husbands) are not included in this table. That would hold true of married men whose wives are abroad (particularly immigrants) whose number must be perceptible. On the other hand, the

number of married women immigrants in this country whose husbands are abroad is probably not very large. The only reason for discarding this computation is the rather startling character of the results indicating a difference of seven years between the age of a married man and woman, which is larger than would naturally be expected. Of course, the tendency to under-estimate age on the part of the married female must be taken into consideration.

Ages of Surviving Children.

Where benefits are granted to surviving children up to a certain age, whether 16 or 18, their ages are a matter of importance. There is no reason to assume that the distribution according to age of the children surviving persons fatally injured would on the whole be any different from a general distribution by age of children under 18 or 16 years in this country. For this purpose the statistics of the United States Census may be utilized. When this was done, it appeared that the distribution among different ages beginning with under 1 year and up to 17 years was fairly uniform. There was a slight excess of children of lower ages but this was comparatively small. Thus, for instance, the number of children under 6 years of age constituted 36.3 per cent. instead of 33.3 per cent. It is therefore safe to assume the mean to represent the average age fairly accurately. In other words, if the law provides compensation up to the age of 16, it is fair to assume 8 as the average age, and if the law extends the compensation up to 18 years of age, the assumption should be of an average age of 9. That slightly over-estimates age. On a more careful computation, it would probably prove to be lower than that. On the other hand, because of the factor of compound interest, the value of a temporary annuity lasting until the age of 18 as computed at the age of 9, would probably be larger than the average value of annuities up to 18 years of age computed for children of ages from 1 to 17, so that those two factors counteract each other, and for the purpose of simplicity the mean may be accepted.

In certain states this formula will not apply without modifications. Thus, for instance, the New Jersey act makes the

amount of compensation in fatal accidents dependent upon the number of dependents only, but irrespective of the degree of relationship—so much is given to one dependent and a somewhat higher amount in case of two dependents, and so on. The computation of the cost of fatal accidents would present serious difficulties except for the data available from the Washington table. Always remembering that a distribution in New Jersey between single and married persons would be different from that in Washington, it may nevertheless be assumed that both of these groups independently indicate the number of cases leaving from one to five or six dependents, and the following table may therefore be used, in which the cases in New Jersey are arranged in proportion to the cases in Washington:

	Married Wash.	Per Cent.	Married N. J.	Single Wash.	Per Cent.	Single N. J.	Total N. J.
1 dependent.....	800	26.6	175	440	49.2	39	214
2 dependents.....	711	23.7	156	338	37.8	30	186
3 "	628	20.9	137	49	5.5	5	142
4 "	413	13.7	90	32	3.6	3	93
5 "	240	8.0	52	13	1.5	1	53
6 "	213	7.1	47	22	2.4	2	49
Totals.....	3,005	100.0	657	894	100.0	80	737

Methods of Application of the Standard Table.

It seems proper to conclude this study of the Standard Accident Table with a brief outline of the methods by means of which the table may be used for determining the comparative costs of compensation acts. In general, the method consists in a careful valuation of the 100,000 accidents according to the provisions of each compensation act. The table is sufficiently detailed to permit such a valuation, and in most cases, it is believed that no additional information is necessary though such a need may arise occasionally. Any experienced actuary will be enabled to make such computations with the aid of the table at hand.

The comparison of the costs of different acts is much simplified by assuming a week's wages as a unit rather than dollars and cents, because almost all benefits in compensation acts are

expressed in terms of weekly wages, and on the other hand, the premiums are computed in percentages of the pay roll, so that in this way any differences between state and state which might arise from differences in wages would be eliminated in the computation. It is evident that in comparing the cost for two states, the differences in wages may be disregarded because they will be automatically corrected in the premium rate.

The computation of the cost of cases of temporary total disability appears very simple by the aid of the series showing their distribution by duration. This series being detailed with intervals of one week only, it is quite safe to assume that the average duration of a case in each group is equal to the mean of the limits of that group. Then the waiting period may be deducted from the average duration for each group, and for the compensated period the proper percentage of wages, whether it be 50 per cent., 60 per cent., or any other percentage, may be computed. One can readily see how easy it is to compute the cost of any changes in waiting period or in the treatment of these cases by applying the table as indicated.

The cases included above do not represent the entire expense for temporary total disability. In every case eventually leading to permanent partial disability, including cases of dismemberment, there is a preceding period of total disability which often is compensated for independently of the benefits for the permanent partial disability arising subsequently. The method of valuation which may be used for this part of the cost of the cases is identical with that used for the preceding group. The same conditions of waiting period apply here. The most important fluctuation between states refers to the question of dismemberment, since in some states it is definitely provided that the so-called specific dismemberment benefits are exclusive of any other payments. In such states, therefore, this additional cost of temporary total disability in dismemberment cases may be disregarded.

The cost of dismemberment cases can be computed very easily by means of the table giving the distribution of the dismemberment cases, since almost all the compensation acts contain a definite schedule giving the amount of benefits payable for each kind of dismemberment. Since payments for

some of the graver cases of dismemberment are for fairly long periods, the question of commutation of future payments arises. It is true that in the past it was not customary to take into consideration the difference between present and future values in computing the experience in the casualty business. It seems necessary, however, in actuarial work in connection with compensation problems to introduce this factor of the commutation. Under old liability conditions, neither the amount of payments to be made nor the time when they were to be made could be foretold in advance with any degree of accuracy. Therefore, the addition of all payments made no matter when was assumed to represent the true cost. Whatever profit was made as a result of deferring payments went into the investment account, and for this reason insurance companies were often able to earn a profit although showing a loss in their underwriting accounts. Compensation legislation makes the period of payments quite definite, and wherever it may seem advantageous to settle in lump sums in advance of the time when payments are due, most of the laws require the commutation of such payments to be made according to definite rules. It is therefore necessary to take account of such differences between present and future values. It is quite evident that the increase of the benefit periods from five years to ten years, for instance, would not necessarily be equivalent to a doubling of the cost, not only because of the lower value of deferred payments, but also because of the possible effect of mortality, as in most compensation acts benefits cease on death of the injured person or the beneficiary from causes other than due to the accidental injury. Moreover, in cases where life pensions are granted, as for instance to widows in some states and to cases of total permanent disability in a great many other states, it is quite impossible to compute the cost at all unless the actuarial factor of present value of annuities is taken into account.

In computing the cost of permanent partial cases other than dismemberments, the distribution of such cases by degree of disability is useful because the amount of benefits would be expressed in a percentage of the weekly wages proportionate to the degree of disability. A short-cut method seems to be

indicated by computing the average degree of disability for all cases of this group. The cost of these cases will then be governed by the scale of compensation contained in the act, by the number of these cases, and by the number of weeks for which benefits under this provision must continue. As a matter of fact, it is probable that in only a small percentage of cases under our experience will permanent partial disability be compensated by very small weekly benefits. Much more likely is the commutation of such cases, except the very severe ones. But that should not influence the cost of the commutations done under supervision of Accident Boards or Commissions, as the present value is presumably computed in accordance with the provisions of the law.

As far as the few but expensive cases of permanent total disability are concerned, the method of computing the cost may be the same as that for permanent partial disability except that cases being those of total disability, there is no question as to the degree of disability, and the full value of the compensation scale is payable in such cases. Wherever the payments are limited in the law to a certain number of weeks, a temporary annuity for that period may be computed while in the few other states providing life pensions, life annuity has to be figured on. Almost without exception these benefits cease on death not due to the accident, which of course would be taken into consideration in figuring either temporary or life annuities.

In regard to fatal accidents, there may perhaps be more variations between different states than for any other group. In some states the computation is simple enough because benefits are given for a limited number of weeks and because beneficiaries are not specified and the same benefits are given no matter how many total dependents survive. Under such conditions and especially when the duration of payments is for a short term of years only, the mortality factor of dependents may be discarded on the assumption that if one dependent should die others would survive and appear to claim the remaining benefits. In a few states special computations become necessary as to the number and kind of dependents surviving, but it is believed that the material furnished in this

study will be sufficient to meet most of the exceptional conditions arising out of different acts. Perhaps the greatest difficulty may arise in connection with the valuation of the factor of re-marriage, as is well remembered by all who were observing the preparation of the New York compensation rates. The thorough discussion of the problem of re-marriage at the time indicated the actuarial difficulties arising out of this problem, but since the New York Workmen's Compensation Commission has issued actuarial data for computing the pensions to widows subject to death and re-marriage, these may be utilized in a comparative study. It seems scarcely necessary to point out that such use of the tables for purposes of comparison may be justified, even if for purposes of valuing individual cases and for buying or selling such annuities, the accuracy of the tables may be disputed by some, as has been done.

Burial benefits are granted in some states only in case no dependents survive and in a few states in all cases of fatal accidents. The standard table provides an easy method for accounting for this difference in state laws. Since, however, burial benefits are stated in the act in dollars and the entire computation may be made here with the weekly wages as a unit, it may be necessary to convert the cost of burial benefits into weekly wages by assuming or ascertaining the average weekly wage for injured persons in the state.

When the cost of compensation of the hundred thousand accidents has been computed in terms of weekly wages, an interesting problem arises in connection with the effect of the minimum and maximum provisions. All compensation laws contain some such provisions which are often referred to as "limits." By this is meant the provision of the act limiting the maximum weekly benefit that may be granted irrespective of the wages and also establishing a minimum, in case the regular scale granted by the law would produce an amount insufficient even for the direst needs of the injured or his family. Like all other provisions these limits vary greatly. Perhaps the most frequent type is that of $5 to $10, though the minimum falls in one or two states to $4 and it rises in some of the western states to $6. The maximum provisions are often increased to $12 and in some states to $15 a week. There has

been a good deal of discussion as to the results of these limits upon the cost of compensation. Commissions have often argued that the maximum limit materially reduces the benefits provided and therefore the cost, while on the other hand, insurance men have frequently claimed that minimum provisions are an additional burden of great magnitude.

As far as the writer knows no specific method of measuring the results of such limits has ever before been suggested. Since these limits cannot be disregarded in comparing the cost of two acts, a method of fairly exact measurement is presented here which is convenient because of its simplicity, provided sufficient data are available. These consist of some statistics as to distribution of injured persons according to wage group. Data as to the average wages, so common in American statistical literature, would be of no advantage in this connection. Given the distribution of injured persons by wage groups, the method is to compute the average benefits which would be granted to the total number of injured persons included in the table (or to 100 injured employees if the table has been converted to a percentage basis) if there had been no limits. Then a similar computation is made to obtain the average benefits granted with proper regard for limits, by increasing the benefit up to the minimum limit for the lower wage groups and cutting them down to the maximum limit in the higher wage groups. If the statistics of wages by groups is sufficiently detailed, the mean wage of each group may be safely accepted as the average. When these computations are made a comparison of the total benefits which would be payable to the entire group without any limits, and the benefits actually payable with due consideration to the limits, would indicate the measure of influence of the weekly benefit limits, which may be an additional charge in some cases or a discount in others.

The greatest difficulty in applying this method is in obtaining necessary data as to the wage distribution of injured persons in various states. Such data are gradually being furnished by the Workmen's Compensation Commissions or Boards which report statistics of accidents according to the wages of the injured as well as in a great many other ways.

In other cases special investigations may be found in the reports of respective bureaus of labor statistics. It is believed that such data are available at present for a few states, as Massachusetts, Minnesota, Illinois, California, and others. In a case of adjoining states, it may be safe to assume the wage scale to be fairly uniform throughout the larger territory.

In general, the effect of the lower limit is to increase the cost of compensation and the effect of the maximum limit is naturally in the opposite direction. The effect of the two limits being contrary to each other, the results seldom indicate any very large correction for limits, at least as far as weekly benefits are concerned. With the 50 per cent. benefit scale it will be found that the minimum limit has greater importance in increasing the benefits than the maximum limit in reducing them, and therefore as a rule it may be said that in states having a 50 per cent. benefit scale the results of the limits will be an additional charge upon the cost of compensation. On the other hand, where the scale of compensation is two thirds or anywhere near it, comparatively few cases fall below the minimum limit, while the maximum may decrease the cost in a great many cases. As a result a cheapening of the cost is sometimes produced by low limits when a two thirds scale of compensation obtains. Thus, for instance, a $10 maximum limit is of very little effect in reducing the cost where the benefit scale is 50 per cent., but it does effect a substantial saving on a two thirds benefit scale.

More complicated are the problems created by the maximum limits established in the acts for the total amount of compensation payable, which apply particularly to cases of death and permanent disability, when the money limit is such as to cut down the period for which benefits may be paid, in all cases where the weekly benefit is a little larger than usual. In other words, the money limit reduces the number of weeks for which compensation may be paid in certain cases, the effect of the money limit depending largely upon the wages. It is evident that the final effect of such maximum money limits depends upon the number of cases which will be affected thereby. In other words, it depends largely upon wage distribution. In order to ascertain, therefore, the effect of such

money limits, it may be necessary to distribute the total number of cases subject to the provision by wage groups, compute the cost of all cases both with and without consideration to the maximum limits, and in that way give proper weight to the effect of the limits which may be exercised in only a few of the cases.

Finally, after the cost of compensation payable in the hundred thousand accidents is computed, the question of the cost of medical benefit remains. It is readily admitted that while the cost of medical and surgical aid represents a very substantial part of the total cost of compensation, it is very difficult to estimate such cost from the provisions in the acts themselves, and therefore it is impossible to apply the standard table method for ascertaining the cost of medical benefits. It seems that for this part of the cost it is necessary to revert to direct experience. For Massachusetts and one or two other states a certain amount of experience is available which indicates the proportion between the cost of compensation and the cost of medical aid, and the proportion may be utilized to load the cost of the hundred thousand accidents as ascertained above by the proper percentage for medical aid. It is true that the provisions for medical aid are subject to some variations between states, and nothing better than an estimate by judgment as to the value of the differences in the provisions of one act and the other, can be suggested here. Fortunately, however, the difference in provisions for medical aid is not so great as that for other features of compensation acts, and any possible errors would not greatly affect the final results.

The methods which may be used in computing the comparative cost of different compensation acts by comparing the cost of the hundred thousand accidents in different states, have been described here in sufficient detail to enable independent students of the problem to apply them. Theoretically all students should get exactly the identical result while working independently. As a practical matter it is hardly fair to expect that, because inevitably some little differences of judgment may arise. There is, therefore, no intention to claim that all the details of the method presented here are infallible. There can be little doubt that the actual experience of com-

pensation insurance in this country, after sufficient time has elapsed to permit its careful study, may introduce some corrections in the table itself or in the results as obtained from the table. There may be differences in interpretation of the law in different states, which are not evident in the language of the acts themselves, and when the problem is to ascertain the comparative cost of the Compensation Law before it has even gone into force, it is evident that no account can be taken of such differences of application of law. Since the Standard Accident Table depends upon an assumption of a fairly well distributed industry, it is possible that in some states in which certain industries predominate, they may affect the Standard Table itself. These and other qualifications must be kept in mind when applying the Standard Table or the methods as indicated here. The eventual accuracy of the results will depend upon the development of proper accident statistics in this country, but the claim is made for the table and the method as outlined here that in the absence of more accurate statistical data, it is the only one by means of which proper actuarial work in connection with compensation problems can be carried on at the present time.

THE STATISTICAL WORK OF THE UNITED STATES GOVERNMENT.*

By Walter F. Willcox, Ph.D., LL.D., *Professor of Economics and Statistics, Cornell University.*

This is the first time that the American Economic Association and the American Statistical Association have met in joint session and the second time that they have in coöperation considered the topic which is now our theme. The memory of some older members of the two Associations instinctively runs back this morning to the time, more than eighteen years ago, when joint committees of these Associations met around a table in New York to consider the terms of a memorial to Congress in favor of a permanent Census Bureau. The attendance was large and representative; the sessions prolonged and animated, not to say stormy. Finally, the committees reached substantial agreement and the memorial then drafted exerted, I believe, an appreciable influence upon the decision of Congress five years later to make the bureau permanent.

Two earlier precedents are even more encouraging. The first significant improvement in American census practice was made in 1800, with the purpose of testing the health and longevity of the American population. An age classification of the free whites into five periods was then introduced. This concession to non-political considerations resulted directly from petitions originating with the recently reorganized Connecticut Academy of Arts and Sciences, and effectively supported by similar petitions from two older and more influential learned societies, the American Academy of Arts and Sciences at Boston and the American Philosophical Society, located at the seat of government in Philadelphia and under the presidency of Thomas Jefferson, then Vice-president of the United States.

The longest forward step ever taken by Federal statistics was probably that between the censuses of 1840 and 1850.

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The changes then introduced were due in no slight degree to the egregious blunders in the census of 1840, to which students had called attention, and to petitions for an improved census emanating from the New York Historical Society and the then youthful American Statistical Association. In now debating the condition of federal statistics, with a view to determining our individual responsibilities as scholars and our collective responsibilities as learned societies towards its present and future status, these Associations are following a line of notable and cheering precedents.

If one hopes to contribute individually to the improvement of federal statistics, the first essential is a thorough knowledge of the actual conditions under which the work is done and of the field of inquiry with which the figures are concerned. It is seldom possible to get this knowledge from printed official reports. For example, the census of 1870 reported that 12 per cent. and that of 1910 that 21 per cent. of American Negroes were mulattoes. The obvious interpretation is that these two races have been intermingling rapidly since the Civil War. We are not informed that in 1910 for the first time many of the enumerators employed were Negroes, that private inquiries conducted by Negro enumerators have shown a proportion of mulattoes much greater than census returns of similar date and place, and that this administrative innovation may explain much or all of the reported increase of mulattoes. The figures do not prove and perhaps hardly strengthen the inherent probability that miscegenation has increased.

How many members of our Associations who use the statistics of immigration know, what they could hardly learn from the reports of the Bureau of Immigration, that the meaning of the word *immigrant* as its statistical unit has been several times altered by bureau circulars and the comparability of the figures for the successive years disturbed? How many know that until recently an immigrant "bird of passage" was counted as an immigrant when he arrived in the spring, was not counted when he departed in the fall, and was counted again as often as he returned?*

*See the writer's "Our Gain in Population Through Immigration" in *National Civic Federation Review*, Nov.-Dec., 1906, p. 7.

Closely related with this need for a thorough knowledge of any inquiry whose results one uses is the need for measuring or estimating the amount and direction of the error in the results. This is quite other than the probable error with which mathematical statists are concerned. It seeks to learn whether the reported figures are above or below the truth and by how much. In a complicated series of inquiries each set of answers has its own margin of error, and an estimate of one throws little light on another. The reported number of married women is slightly too large because for a woman to allege marriage is to state a claim; the reported number of divorced women is far too small because such a report is a confession of fault or failure.

The greater the importance of one's statistics for the purpose he has in hand, the stronger becomes the need of determining whether they may be trusted to the degree implied in the argument, just as the taller the building, the deeper and firmer must be its foundations. Is there no danger that towering and impressive constructions of economic speculation are being erected both in the United States and in Europe with too little effort to make sure that the statistical foundation is bed-rock? Is there no danger that some of these may prove ultimately to be ill-founded? This is a peril against which mathematical statists may need to be warned. To voice that warning, I cite two examples from the mistakes of mathematical geniuses.

Before and for many years after 1790, when the United States took the first national census on record, the opinion was current among European statists that to enumerate a country's population was impracticable. Needing to know the population of France, Laplace secured a count of the residents in certain scattered districts and also of the annual number of registered births. These facts gave him a ratio between births and population which he applied to the whole of France. The process was legitimate, but in defending it Laplace went into an elaborate mathematical demonstration showing with pages of formulæ that there was not one chance in one thousand that the error of his estimated population would exceed 500,000. Today it is demonstrable that his estimated popu-

lation was under the truth by more than 2,000,000, or 9 per cent. of the total, and that the mistake lay not in his mathematics but in the number of registered births in France, to which he applied his ratio.*

If any mathematician held a position in the United States at the end of the nineteenth century comparable to that held by Laplace in France at its beginning, it was probably Simon Newcomb. Because of his eminence, I venture to feather my warning shaft with an example from his statistics. In his brief *Statistical Inquiry into Sex in Human Offspring*† a main object was to show that "the treatment of statistical data generally on a large scale by the rigorous methods of probable induction leads one into a field the cultivation of which promises important results to the science of the future."‡ The first of his six conclusions was: "The preponderance of male over female births probably varies with the race . . . it seems to be either non-existent or quite small in the negro race." This conclusion was founded entirely upon census figures§ which are subject to a margin of biased error, so wide that they have no probative value. Furthermore, the conclusion is directly contradicted by the few American registration figures of births by race and sex,—to which no reference was made, although the best of them were published by the city in which the article was probably written.

The keen interest in economic or statistical theory, which expresses itself more and more often in a mathematical dress, is not infrequently associated with a distaste for the patient and competent testing of the basic facts. This

* The earliest and fullest statement of Laplace's argument is in his contributions to *Histoire de l'Académie Royale des Sciences* for 1783, printed at Paris in 1786. After several unsuccessful inquiries of the larger American libraries, these volumes were found in the library of the American Philosophical Society at Philadelphia, which kindly sent them to Ithaca for my use. Laplace clung to this method at least until 1814, when his *Essai Philosophique sur les Probabilités* appeared (See *Oeuvres Complètes*, 1843–47, Vol. VII, pp. lvi, f.) and his disciple Quetelet until 1827, when its keen criticism by de Keverberg won Quetelet over to the method of enumeration, of which he soon became the most convincing and effective advocate. My criticism applies to the form of Laplace's estimate set forth in his *Essai Philosophique*, when it can be tested by census and registration figures. For evidence that his estimated population of France, 28,352,845 in 1802, was below the census figures and that those were below the truth, see Jacques Bertillon's *Stat. Intern. résultant des Recensements* (1899), pp. 30 31.

† Simon Newcomb, *A Statistical Inquiry into the Probability of Causes of the Production of Sex in Human Offspring*, Carnegie Institution of Washington, 1904.

‡ *Id.*, Prefatory Note.

§ *Id.*, p. 8.

neglect may lead to building structures on foundations of sand and to compromising the reputation of our guilds in their collapse. Certainly the contrast between the magnitude of the superstructure and the slipperiness of the foundation is often glaringly apparent to those who have struggled in deep waters to lay the foundation and is in no slight degree responsible for the attitude of quizzical aloofness with which these structures are viewed by some who know much about their basis.

I dwell upon this suggestion because I have long believed it to be needed and perhaps never more than now when the growing enthusiasm for mathematical statistics in Europe and the United States and the inability of many producers of official statistics to follow or criticize intelligently the interpretation placed upon their own figures may result in reviving a separation, which I hoped was of the past, into groups of official and private statists, each somewhat ill-informed about the other.

The most serious obstacle to sound work in federal statistics is probably the over-emphasis upon its political aspects. All official statistics are political and in a sense partisan; they cannot be entirely divorced from politics within any future period of importance to the present discussion, yet for a century their scientific or rational meaning has been slowly gaining recognition. This change it is the duty and privilege of our Associations to support and urge forward. To that end we need to provide in our universities better training for statists, public or private, and to instil into them a sense of the scientific value of their work. We need to exercise an influence in favor of long terms of service for statists who have earned retention and for the promotion of those who show natural aptitude. Perhaps nothing would further this purpose better than to see some of our large offices become training schools in producing the future official statists of the country. They are not now trained in our universities and they cannot be well trained without enjoying the laboratory experience of a well-managed office. Universities situated near such laboratories might profitably arrange collaboration with them, like that between medical schools and

hospitals or that between many European universities and the statistical offices of the cities in which they are situated. In this respect the Bureau of the Census has proved a disappointment. It has done little to train men so that they could rise to higher positions in the office and in so doing lift the office staff to higher levels of efficiency; much less I believe than the Coast Survey or the Geological Survey or the Bureau of Corporations has done. Largely as a result of this overemphasis upon the political aspects of its work and neglect to train men for promotion, the quality of federal statistics is not improving as fast as the quality of statistics in private corporations or the quality of federal work in geology or geodesy. Perhaps, indeed, the deterioration is absolute as well as relative.

What should these Associations do toward improving federal statistics?

For the present, I have but one suggestion. It would be expedient, I believe, for each Association to appoint a committee on federal statistics, with power to enlarge its membership, and to coöperate with the corresponding committee of the other Association. These two committees might divide the field of federal statistics between them and start a person at work if possible on each main field. Each coöperator would be invited to prepare a report on the recent progress and present condition of statistics within the field assigned him and to embody recommendations for its future improvement. The reports would be laid before the main committee for editing. Those which received its approval would then be submitted to the Associations for printing.

In this manner our Associations might secure for themselves and the public a series of deliberate, reasoned and expert opinions upon the subject of our conference. If this effort should prove successful, it would aid us in deciding whether further steps were desirable. Perhaps the time would be found ripe for an expression of opinion from one or both of these Associations regarding federal work in statistics or certain branches of it which would influence it helpfully in the future as similar expressions of opinion from these and other learned societies have helped it in the past.

HOW THE STATISTICAL OUTPUT OF FEDERAL BUREAUS MIGHT BE IMPROVED.*

By W. C. Mitchell, Ph.D., *Professor of Economics, Columbia University.*

Professor Willcox remarked incidentally that no man is in a position to criticize the statistical work done by the federal government unless he knows intimately the whole set of processes by which the final results are obtained—how the original data are collected in the field; how they are tabulated, summarized, and averaged in the office; and how the textual explanations of the tables are prepared. I concur heartily in the justice of this observation. By rights, it rules me out of the discussion. For despite three brief periods of employment by federal authorities—the Census Office, the Immigration Commission, and the Bureau of Labor Statistics—I have but a limited acquaintance with the production of federal statistics. It is as a consumer of statistics that I speak—primarily as a consumer of statistics of prices and wages—and I recognize that the consumer's impressions may be mistaken. However, I give them for what they are worth.

The field work of collecting data respecting prices and wages seems to me better on the whole than the office work of making these data into finished bulletins. For in the bulletins I have found much that is not clear, and not a little that is patently misleading or flatly wrong. But in so far as I have been able to test the original data I have found that they are consistent among themselves and consistent with similar figures compiled by other investigating authorities. In short, they seem to have been collected honestly and intelligently.

The reason for the relative inferiority of the office work appears to lie in the organization of the office force. The chiefs of the bureau which has done most work in this particular field have all been forceful and capable men. The clerical force has stood on a level rather above that common

* Remarks made at a joint meeting of the American Statistical Association and the American Economic Association, Princeton, N. J., December 30, 1914.

to government offices. But this bureau has lacked an adequate staff of skilled statisticians capable of understanding the purpose of an investigation, and of directing the work of the clerks under the general supervision of the chief, of making the most intelligent use of the data collected by the field agents and of preparing lucid text which tells what the tables mean. It goes without saying that the head of a bureau cannot give personal supervision to all the many tasks imposed upon his office; and if he has not assistants who are really capable investigators trained in the use of statistics, much of the work turned out will be mediocre in quality.

The weakness of the organization in this respect arises from the fact that the bureau concerned can not offer a satisfactory career to capable men. Adequate salaries can not be paid; adequate recognition can not be given. A few men of the quality required have stayed by the bureau year after year, and worked efficiently under most discouraging circumstances. These individuals merit more honor than they will ever receive for the sacrifices they have made and the service they have rendered. But their number is by no means adequate. The efficiency of a government bureau cannot be maintained indefinitely by exploiting the statistical enthusiasm or the patriotic philanthropy of its staff.

If I am right about the chief cause of weakness in the statistical work done by the government, the remedy lies in the hands of Congress. What we may do as individuals to aid the heads of the statistical bureaus in securing adequate appropriations for their staffs is not much, but it is better than nothing. By using the statistics which are already being published, we can show that there is a public demand for work of this character. By using this material critically, we can show that there is need of improving the product now supplied. By seeking to put the blame for such faults as now exist upon the proper shoulders, we may perhaps bring home to some members of Congress the necessity of making better provision for the support of statistical work. If we can accomplish something in this direction as individuals, as members of the American Statistical and American Economic Associations we can accomplish more. Accordingly, I endorse

heartily the plan of coöperative effort which has been outlined by Professor Willcox. But I anticipate that his committee will find that the measures of greatest practical promise for improving the statistical work now done by the government lie along the line which I have suggested.

THE STATISTICAL WORK OF THE UNITED STATES GOVERNMENT.*

By E. Dana Durand, Ph.D., *Former Director of the Census.*

Much might be said regarding the need of extensions of the field of federal statistical work. The most important additions immediately desirable are perhaps annual statistics of manufactures and of agriculture. We already have annual returns, based on actual enumeration and not on estimate, of the mining industries and of cotton ginning, and until recently we had annual returns of lumber cut. There is an equally strong demand for annual data, promptly published, of leading manufacturing industries and of the principal crops and domestic animals.

The need for current data regarding agriculture is by no means satisfactorily met by the estimates of the Department of Agriculture. The margin of error in these is extremely large. The principle followed in arriving at the acreage of crops and the number of domestic animals is to take the decennial census as a starting point and to add or subtract annually estimated percentages of change as compared with the preceding year. These percentages represent merely a consensus of guesses. An error in the estimate for one year continues to affect the figures for each succeeding year until the next census. Since errors in estimates tend, owing to psychological reasons, to continue in the same direction for a series of years, the cumulative error may become very great. For some states the estimates of the Department of Agriculture as to the acreage of certain crops for the year 1909 were several times greater than the figures returned by the census. In some other states the Department's estimates were as much as 50 per cent. too low. For the United States as a whole nearly all estimates were found at the time of the Twelfth Census to be materially too low and nearly all those at the time of the Thirteenth Census to be materially too high.

* Paper presented at a joint meeting of the American Economic Association and the American Statistical Association, Princeton, N. J., December 30, 1914.

The error in the agricultural estimates would, of course, be reduced by a quinquennial census of agriculture. By a law of 1909 the Census Bureau was authorized to take a simple agricultural census in 1915 and every ten years thereafter, but the present Congress has thus far shown an indisposition to provide the necessary appropriation. In any case a quinquennial census would be only a palliative, not a remedy for the existing evils.

Annual statistics for leading crops and domestic animals, based on actual returns of farmers, would involve comparatively little expense. The rural mail carriers, who cover by far the greater part of the cultivated territory of the country, could collect the data. In course of time it would become possible to induce most farmers to fill out the schedules themselves. The Department of Agriculture recently made an experiment with this method. The proportion of farmers who filled out the schedules delivered to them by the mail carriers was comparatively small. The results of this single experiment, however, do not seem conclusive. There was no law compelling farmers to fill the schedules and farmers were unfamiliar with the scheme. A compulsory law may possibly be unwise at present. Even without it, the system should work fairly well after a few years' experience. In any case the value of accurate annual returns of agriculture would be so great as to justify considerable expense.

The inadequacy of a quinquennial census to show accurately even the general trend of manufacturing industries is obvious, while it completely fails to disclose current conditions. Were an annual canvass of manufactures undertaken it would become year by year increasingly possible to secure the returns by correspondence. This is the method used for the most part by the Geological Survey in obtaining data for mines. It has also been successfully used for manufactures in Massachusetts. The schedules for annual returns might well be far simpler than those used at the quinquennial census of manufactures. They might be confined to inquiries as to the quantity and value of the leading individual products and as to the number of wage-earners, leaving inquiries as to capital, expenses, materials and the like, if such are deemed necessary at all, for the quinquennial or even the decennial enumerations.

In this connection it should be noted that even the elaborate quinquennial censuses of manufactures fail to present a great deal of information which is in great demand. As regards many industries, there has been no attempt to ascertain the quantity or value of specific products. While, for some of these industries, it is scarcely practicable to obtain such data, there are others for which they could be obtained. Moreover, there is much demand for information regarding industries more narrowly limited than those distinguished by the census classifications. Owing to the fact that several branches of business are often carried on by a single establishment, the Census Bureau has more and more adopted the policy of classifying establishments according to very broad groups. When tariff bills, for example, are under discussion, information is demanded for specific industries, not groups of industries. Such information could be compiled and published at least for selected establishments which are free, or largely free, from the complexity of overlapping.

The president of the American Statistical Association, in his annual address, suggested the desirability of a committee of expert statisticians to serve as an adviser to the statistical bureaus of the federal government. Other speakers have touched on the same thought. Doubtless a good deal could be accomplished by the creation of a joint committee of the American Economic and American Statistical Associations holding no official relation to the government. Still more, however, could be accomplished by an advisory commission created by the government and comprising statisticians and economists from the universities and other experts who should devote only a fraction of their time to the work, as well as officials continuously employed in government statistical investigations.

In order that the work of such an advisory body should be of the greatest value, its members would need to devote a good deal of time to it and to incur considerable travel expense, both in mutual consultations and in conducting investigations at Washington and elsewhere.

It will be recalled that these two associations at the time when preparations were being made for the Twelfth Census,

organized a committee to make suggestions. For the most part the work of that committee consisted of monographs prepared, wholly or substantially, by individuals. Useful as these were, they were less useful than would be reports based on extended consultation and discussion. The holding of such consultations by members of a widely scattered committee means time and travel expense.

Moreover, it is essential for any proper criticism of the federal statistical work that the critics should thoroughly familiarize themselves with the actual methods of the various statistical bureaus—the methods of collecting the original data, of editing the schedules, and of tabulation. They must know about tabulating machinery, about processes, and about costs. They must examine original returns and gain some idea as to the margin of error in them. Statisticians outside of the government service are altogether too lacking in information on such points as these. In most branches of statistical work we need at present, far more than any extension of the field or any improvement in the methods of analysis, an increase in the degree of accuracy of the raw material. It is very largely to this task that such a proposed committee should at first address itself. Obviously, in order that a committee of experts should secure the necessary information on which to base recommendations along this line, it would be essential for them repeatedly to visit Washington and to incur considerable expense.

An official commission established by the government would presumably be able to secure appropriations for expenses of this character. Further advantages of such a commission would be the fact that it would have more complete access to information than an unofficial committee, and the fact that its recommendations would doubtless have somewhat greater weight with administrative officers and Congress.

It is possible that the necessary expenses of an unofficial committee on federal statistics might be provided for by private subscriptions. Should the proposed joint committee of the Statistical and Economic Associations find it feasible to coöperate with various commercial and business organizations, which are likewise interested in the improvement of

government statistics, these organizations might aid financially in the work.

The present time is hardly propitious for legislative or administrative action creating an official advisory commission on statistics for the federal government. Every effort is being made to reduce expenditures. The first step is clearly the creation of a joint committee of these two associations and action looking toward an official organization should be deferred until a more suitable time. The joint committee might well consider the elaboration of a plan for such statistical commission as part of its task.

A third topic to which I wish briefly to allude is that of coöperation between the federal government and state and local governments in statistical work. To some extent, coöperation may properly take the form of the employment of state or even municipal agencies to collect statistics for use by both the local and the federal governments. The Massachusetts Bureau of Statistics has to a large extent acted as an agent for the federal Census Bureau in this way. Unfortunately, however, the standard of statistical work in most states and cities is not so high as that demanded by the federal government and the extension of coöperation of this type can be gradual only.

On the other hand, it would seem possible for the federal government to coöperate extensively with the state and local governments in another way, namely, by rendering available for special local uses the original data collected by the federal government itself for more general purposes. There is great demand in some states and cities for the presentation of more details as to small localities than are published by the federal government. This is notably true with respect to the censuses of population, agriculture, and manufactures. For example, a reasonable amount of detail regarding population and agriculture is desirable for townships; the Census presents data only for counties (except, of course, that the number of inhabitants is given for townships).

The federal government properly feels that it cannot afford to tabulate and publish information as fully for small areas as it does for states or for the country as a whole. It should,

however, be willing to place the results of its canvass at the disposal of the states for the purpose of more detailed local presentation or at the disposal of individual cities, counties, or other local governments. The federal government might offer the state or local governments gratis the original schedules after it had finished with them. It might furnish, more promptly, duplicates of those schedules, the cost of which would be low, to be borne locally. Again, the federal government might, on request, itself tabulate and publish the desired details at the expense of the states or local governments. None of these plans can be satisfactorily carried out without new federal legislation. At the last census there were a number of cases in which states or local governments were willing to bear the expense of special tabulations or of copying schedules. The census officials were perfectly willing to comply with their wishes, but found it almost, if not quite, impossible to do so under existing provisions of law, as to confidential treatment of returns and as to financial procedure.

Much of the raw material of statistics collected by the federal government is only partially utilized at present. Valuable metal is left in the ore. Further local elaboration of this material would in many cases be more useful to states and local governments than the special censuses and other statistical investigations which they themselves undertake. Coöperation is the obvious thing. Of course it would be possible also for the federal government, under proper conditions, similarly to make its statistical resources available for private organizations and even individuals.

SOME FEATURES OF THE STATISTICAL WORK OF THE BUREAU OF LABOR STATISTICS.*

By Royal Meeker, Ph.D., *Commissioner of the Bureau.*

I agree with much that Professors Willcox and Durand have said. I believe that it is desirable to secure comparability and continuity in our statistical output. In revising the statistical work of the Bureau of Labor Statistics I have kept these things in mind and, so far as possible, have constructed the new series of price and wage indexes so as to admit of comparisons with the old indexes. The new wholesale price index number will be calculated back to 1890 so that the old index and the new may be compared throughout the whole period since 1890. The retail price index, however, has been calculated back only to and including 1907, for two reasons: First, because of the enormous amount of labor involved and the insufficient force and funds of the Bureau, and, second, because since 1907 retail prices have been much more accurately reported by merchants than previously, greater care being exercised to obtain the actual salé prices on the 15th of each month of the same grade of each commodity sold by each store. The price quotations before 1907 and since that date are so different that comparisons cannot fairly be made. No good purpose can be served by calculating the relative prices and index numbers back of 1907. Such a continuous series of relatives and indexes would give merely a fictitious comparability and continuity to retail price statistics, the prices themselves being discontinuous and incomparable.

It was my desire to carry back through 1907 the new index numbers showing changes in hourly rates of wages, full time weekly earnings, and weekly hours of labor in different industries. In some industries, however, the number of establishments reporting in 1911 was greatly increased over the number in 1910, so that no fair comparison could be made going back of 1911. It is unfortunate that the relatives and index

* Paper presented at a joint meeting of the American Economic Association and the American Statistical Association, Princeton, N. J., December 30, 1914.

numbers cannot be carried back in every instance to 1890, but I feel that it is better to make no comparisons of wages and prices rather than to make erroneous comparisons by means of a fictitiously continuous series of relative prices, wages, earnings, and hours of labor.

I sincerely hope that the proposed joint committee of the Economic Association and the Statistical Association, to advise with the statistical bureaus of the government, will be appointed. Unnecessary duplication of statistical work should be eliminated, and the statistical methods used should be standardized and made uniform. Especially is standardization and uniformization of methods needed in the different commonwealths of the United States. For example, the accident statistics of one state cannot at the present time be compared with the accident statistics of any other state because the statistical methods are so utterly at variance.

The various statistical bureaus in the federal service are getting together as never before so as to avoid duplication of effort and to agree upon the right things to do and the right way to do them. I am trying to prevail upon the various state agencies to coöperate with the Bureau of Labor Statistics and with each other in the gathering of statistics of accidents, unemployment, retail prices, wages, and hours of labor.

It is slow and discouraging work, but great good will result, if we can agree upon what statistics should show and the best methods of showing what is wanted. The committee suggested would be of great service in establishing proper statistical standards, in calling attention to the enormous quantity of costly and useless statistical output, and in eliminating duplication of work and the confusing and costly publication of more or less contradictory statistical stuff by various federal and state agencies.

Most treatises on statistics deal exclusively with statistical methods. Nothing is said about the data to which correct statistical methods are to be applied. Now all experience shows that the principal source of error in statistical work lies in the original figures collected to represent wages, prices, hours of labor, etc. It is much more important that we give attention to the gathering and verification of the original data,

than that we devote our efforts to hair-splitting refinements in the methods of treating the facts gathered. With all the treatises on statistical methods, however, we have not learned the difference between right methods and wrong methods in our statistical analyses. In fact, the treatises themselves are generally very vague or perfectly noncommittal as to the applicability of a given statistical method to a given set of conditions. Some writers seem to think that it really doesn't much matter what statistical methods we employ, as approximately the same results are obtained by any and all methods. I do not hold this comfortable view. I believe there is a right way and a wrong way of doing things. I believe it is of first importance to get our facts right, but I am convinced that the most irrefragible facts are sometimes made to tell lies because they are treated by wrong statistical methods.

Long before I took charge of the Bureau of Labor Statistics, I had become very suspicious of the Bureau's index numbers, especially its retail price index. Some people here present will no doubt recall that I was wont to have fun with the Bureau's index numbers. I no longer have fun with them—they have fun with me. As soon as I took charge of the Bureau, before I had got settled in the saddle, I set about to revise and recalculate the index numbers published by the Bureau. Perhaps some of you will recall receiving more than a year ago a letter from the Commissioner of Labor Statistics—a S. O. S. call for help. I did not have the self-assurance to set about revising the index numbers without first taking counsel with those who were best qualified to advise me in this matter. Many of you who received this distress signal may remember carefully depositing it in your waste basket. At least I received no reply from a number of economists and statisticians whom I addressed. Most of you who did reply may remember dictating a perfectly perfunctory reply which revealed either that you did not know or care much about index numbers, or that you did not wish to prolong your correspondence with the Commissioner of Labor Statistics. I want here and now to acknowledge publicly the assistance given me by Professor W. C. Mitchell and Professor Irving Fisher. Had it not been for the sympathy, encouragement, and counsel of Professors

Mitchell and Fisher, I should not have had the courage to carry out the recasting of the Bureau's index numbers. I have changed the methods employed in constructing the index numbers and shifted the base period from 1890–99 to the last completed current year. It has been a most laborious and tedious undertaking, but the work is now nearly completed.

That the method used in constructing index numbers is not an inconsequential matter is shown by a brief examination of the following table:

PRICES OF POTATOES FOR MAY, JUNE, AND JULY, 1913.

1. Firm.	May.		June.			July.		
	2. Price.	3. Relative on May base.	4. Price.	5. Relative on May base.	6. Relative on June base.	7. Price.	8. Relative on June base.	9. Relative on May base.
804	$0.20	100	$0.40	200	100	$0.30	75	150
808	0.17	100	0.36	211	100	0.32	89	188
815	0.50	100	0.40	80	100	0.35	87½	70
817	0.20	100	0.20	100	100	0.30	150	150
821	0.20	100	0.40	200	100	0.35	87½	175
City aggregates	$1.27	500	$1.76	791	500	$1.62	489	733
City relatives	100	100	139	158	100	92	98	147

City relative for July on May base computed by averaging and multiplying relatives	155
City relative for July on May base computed by comparing aggregate actual prices	128

This table gives the prices of potatoes during the months of May, June, and July, 1913. These prices have already been published by the Bureau of Labor Statistics. The prices were reported to the Bureau by five identical firms in one city—all the identical firms reporting for that city for the three months, May, June, and July.

In the first column is given the firm number. In the second column are given the money prices per peck for potatoes as reported by these five firms. In the third column the money prices are reduced to percentages or relative prices, May being taken as the base. Of course, all relative prices for that month are represented by 100. In the fourth column are given the June prices per peck for potatoes reported by these same five firms. In the fifth column are given the relative prices in June on the May base, that is, the percentage of June

prices to May prices. You will notice that some of the prices reported to the Bureau look very peculiar. Firm 808 reports potatoes at 17 cents a peck in May. Firm 815 reports potatoes by the peck at 50 cents in May. Clearly here we are dealing with different economic commodities. No doubt, 17 cents is the price for old potatoes, while 50 cents is the price for new potatoes. Note the phenomenal changes in prices in June as compared with May. The first firm shows an increase of 100 per cent. in the price of potatoes; the second firm shows an increase of 111 per cent.; and the third firm shows a decrease of 20 per cent. Now I wish to emphasize that these prices are actual prices reported to the Bureau by all of the identical firms in one city that reported for the three months under consideration. We instruct our retail grocers to report new potatoes only when the sales of new potatoes make up more than 50 per cent. of their total sales of potatoes. In this case it looks as if some of the firms had not strictly followed instructions, but I have as yet discovered no way of going behind the "election returns." We must rely upon the honesty and intelligence of the firms reporting. Had the prices reported by Firm 815 been called to my attention early enough, I should have eliminated it altogether—at least the price reported for May.

Now let us consider the city relative price constructed by averaging the individual firm relatives for the month of June. The simple arithmetic average of the relatives in column 5 is 158, that is, according to the information given by this relative price, prices of potatoes in this city have risen 58 per cent. from May to June. By comparing the aggregate money prices we get quite a different result. The aggregate prices may be used in the construction of relative prices in this case, because the firms reporting are identical for the months of May and June. Of course, if a different number of firms had reported in May as compared with June, it would be necessary either to compare identical firms or to reduce the aggregate prices to average prices before anything like an accurate result could be obtained. The aggregate money prices in May are $1.27. The aggregate for June is $1.76. Reducing both these money prices to percentages of the May price by

dividing by $1.27, we obtain as the June relative price on the May base, 139. This is almost 20 points less than the June relative price obtained by averaging individual firm relatives—a difference which certainly is not negligible and which is altogether due to the difference in method of calculating the relative prices.

Whatever may be said of the excellences of a general relative price constructed by the method of averaging relative prices built up from different bases for the purpose of showing changes in the cost of living, a relative price built up from actual money prices shows much more accurately what we want to show, namely, changes in the cost of living—changes in the cost of the same quantity of a commodity or of an unvarying market basket.

Since 1907 the method followed by the Bureau in constructing relative retail prices and index numbers has been as follows: Identical firms were compared month by month, the theory being that it is inaccurate to compare changes in relative prices of five firms one month, eight firms the following month, and ten firms the next month. In this way a relative price for February would be constructed on the January base by comparing the identical firms reporting both for January and February. Then this February relative price on the January base was multiplied into the January relative price on the base chosen for all relative prices and index numbers published by the Bureau, namely, the period 1890–99. Next a March relative price was constructed on the February base by comparing the prices of identical firms reporting for these two months. This March relative in turn was multiplied into the February relative price constructed on the 1890–99 base. In this way only identical firms were brought into comparison month by month. Now this method of bringing into comparison only identical firms is a perfectly good and accurate method, if properly applied, but applying it in this way necessitated shifting the base of the old index number every month. A relative price or index number built up by the method of averaging relative prices constructed on different bases cannot be shifted without a percentage of error that can only be guessed at. Every time the old index was shifted in

the way described above error was injected into the result, and the error was perpetuated and probably cumulated month by month and year by year. I will refer to this source of error a little later on.

Applying the method of comparing identical firms month by month to the figures in the table before us, we obtain an average relative price of 98 for July on the June base, for the five identical firms reporting in both June and July. By comparing the aggregate money prices reported by the five identical firms, we get the July relative price, 92, on the June base.

In column 9 are given the July relative prices constructed directly on the May base. The average of these relative prices is 147. By the method of shifting from one base to another we get a very different result. Multiplying the average relative price for July on the June base (98) by the average relative price of June on the May base (158) we obtain what purports to be the July average relative price on the May base (155). The difference between these two averages of relative prices for July on the May base is 8 points. In the first case the July prices are compared directly with the May prices. In the second case the July relative price on the June base is multiplied into the June relative price on the May base. This gives some idea of the possible discrepancies which may arise from using the method of comparing identical firms month by month, even when there is no change in firms whatsoever.

When we compare the aggregate money prices reported by identical firms in June and July, we obtain a July relative price of 92 on the June base. Now this relative price can be *shifted without error* to the May base or any base desired. This may be best shown by the following simple arithmetical formulæ: $\frac{\$1.76 = \text{June aggregate price}}{\$1.27 = \text{May aggregate price}} = \text{the June relative price}$ on the May base. $\frac{\$1.62 = \text{July aggregate price}}{\$1.76 = \text{June aggregate price}} = \text{the July}$ relative price on the June base. Multiplying the July relative price on the June base by the June relative price on the May base, we have $\frac{\$1.62}{\$1.76} \times \frac{\$1.76}{\$1.27} = \frac{\$1.62}{\$1.27} = 127\frac{71}{127}$, the July relative price on the May base, which is exactly the same result

as would be obtained by dividing the July aggregate in the first instance by the May aggregate. Even with changing firms and commodities varying in quality, the relative prices calculated by comparing actual prices may be shifted to any desired base by the method illustrated above with the closest possible approach to absolute accuracy. Shiftability is an indispensable quality in a relative price which must be built up by computing the relative for each month with the preceding month as the base and then shifting the resulting relative price to the selected base period by multiplying through by the relative price for the preceding month computed on the selected base period. If there were no other reason for changing the method of computation, this alone would seem to make the proposed change in method imperative.

The July relative price of potatoes on the May base computed by the old method employed by the Bureau is 155. The relative price of potatoes for the same month on the same base computed by the new method is 128. The difference is 27 points—a difference so great as to shake one's faith in relative prices and index numbers, if we had nothing to indicate to us whether the relative 155 was better or worse than the relative 128. In fact, however, a relative computed from actual money prices does reflect as accurately as possible the percentage changes in the cost of a given commodity. The relative 128 is, therefore, more trustworthy and exact than the relative 155.

In the same way a weighted index number of the family food budget, constructed by the use of actual money prices weighted according to the quantities of each commodity entering into consumption, is much more accurate and trustworthy than either an unweighted or a weighted index number constructed by the old method of averaging averages of relative prices to the fourth and fifth degree.

The advantage of constructing relative prices and index numbers which can be shifted to any base desired has still another important aspect. People are curious to know the percentage of price change from 1912 to 1913 or from 1907 to 1913, or for some other recent period of time. Few are interested to know by how large a per cent. the prices of 1913

exceed the prices of a period as remote as 1890–99. It is impossible by means of the old series of relative prices and index numbers to calculate accurately the percentage change in prices from 1912 to 1913. For example, from the Bureau's Bulletin 140, p. 16, we learn that the relative prices of round steak were 174.3 and 199.5, respectively for 1912 and 1913. Nobody can from these figures calculate the percentage of change in the prices of round steak from 1912 to 1913. The severest critics of the Bureau's price statistics almost invariably calculate the percentage of change by the short and simple process of subtraction, contenting themselves with the misinformation that the price of round steak rose 25.2 per cent. from 1912 to 1913. A more "scientific" method employed is to divide both relative prices through by the 1912 relative, 174.3, thereby going through the motions of shifting the base period to 1912, and obtaining 100 and 114.5 as the relative prices of round steak for 1912 and 1913, respectively, computed on the 1912 price as the base. The Bureau has resorted to this method in previous bulletins, to construct tables purporting to show the percentage changes in prices from year to year. This method of procedure is mathematically unsound and the result is vitiated by an amount of error that can be ascertained only by digging up the original price data and reconstructing the relative prices anew on the 1912 base. That the possible error is no negligible quantity is demonstrated by a brief consideration of the table below:

PRICES OF POTATOES FOR JUNE AND MAY, 1913.

Firm.	June.		May.	
	Price.	Relative.	Price.	Relative.
804	$0.40	100	$0.20	50
808	0.36	100	0.17	47
815	0.40	100	0.50	125
817	0.20	100	0.20	100
821	0.40	100	0.20	50
Aggregate	$1.76	500	$1.27	372
Relative price	100	100	72	74
Relative price obtained by shifting (100÷158)				63

The relative price for June on the May base computed by averaging relative prices is 158. This quantity is supposed to

give the percentage relation that June prices bear to May prices. It is desired to find what is the percentage of May prices to June prices. Using the usual method of dividing through by the relative price (158) of the period to be used as the new base, we get the following relatives: June 100, May 63. When we compare the money prices and calculate the firm relative prices and average them we get 74, as shown above.

The relative price computed from the original price quotations is more than 17 per cent greater than the relative price obtained by shifting the base in the manner described above.

It must not be forgotten that the figures used are actual prices returned to the Bureau by all the identical dealers reporting from *one* city. This is not a case cooked up for the purpose of showing a theoretical possibility that contains no element of probability. I chose potatoes deliberately because their prices behaved so oddly at just this period when new potatoes are coming in and old potatoes are going out. The example given is extreme, but it is by no means unusual, and such capricious fluctuations are repeated every year for potatoes, and to a lesser extent for eggs and some other commodities that are subject to rather violent price changes. No doubt, more startling examples could have been found by a very little search. These examples are cited to show typical price changes in a commodity that fluctuates capriciously in price, not to exhibit the most extreme cases of such capriciousness.

The relative price computed from aggregate actual prices can be shifted at will to any base without error. This is evident when we consider the nature of such a relative price. The June relative price computed on the May price as 100 is $\frac{\$1.76.}{1.27}$ Shifting this series to the June base by dividing by the June relative price gives the following: May relative price $\frac{\$1.27,}{1.76}$ June relative price 100. Individual commodity relative prices can thus be shifted to the base price of any period desired without error because the relative prices are simple ratios of actual aggregate prices. Dividing through by the relative price of any year or period merely has the effect of

substituting the aggregate actual price for the base period as divisor in the formula for computing the relative price.

By the old method of computation, errors in price data were not only perpetuated but cumulated by means of the vicious method of averaging, to the fourth and fifth degree, averages of relatives calculated from different prices as bases and by the still more unallowable process of shifting every month the base of the relative prices, which could not be done without subjecting the relative prices to grave suspicion as a dependable means of representing accurately what was happening to prices. These inaccuracies, taken with the inflexibility of relative prices and indexes calculated by averaging relatives, made the changes in methods of calculation which have been carried out imperatively necessary.

COÖPERATION OF FEDERAL BUREAUS WITH PRIVATE AGENCIES IN STATISTICAL WORK.*

By John Cummings, Ph.D., *Expert Special Agent of the Bureau of the Census.*

Members of the associations may be interested in an instance of coöperative statistical work in which the coöperating agencies included two federal bureaus, two private associations or foundations, and a local public agency—these being the coöperating agencies in a recently completed survey of industries and schools in the city of Richmond, Virginia. The report of this survey will shortly issue as an official publication of the federal government. Specifically, the coöperating agencies in this work were the following:

1. The National Society for the Promotion of Industrial Education, which was active in organizing the survey and assumed certain expenses for printing bulletins bearing upon the work and for services of its office force. This society has just recently, some three weeks since (Dec. 9–12, 1914), held its annual convention in Richmond, practically the entire time of the convention being devoted to a consideration of the results of the survey and to the formulation of recommendations based upon the findings.

It may be noted as an indication of the value of such work that the superintendent of the Richmond schools stated to the convention that the survey had outlined a program of procedure in industrial education providing for the development in Richmond during the next ten years. Incidentally he stated that the survey had already saved the city $250,000.

2. The city of Richmond itself, represented by the Superintendent of Schools and by a local committee of citizens. Richmond provided funds to cover the cost of making a survey of its industries.

3. The Russell Sage Foundation of New York City, which through its Educational Director made the school survey and assumed a large portion of the cost of the school survey.

* Paper presented at a joint meeting of the American Economic Association and the American Statistical Association, Princeton, N. J., December 30, 1914.

4. The United States Bureau of Education, represented by its expert in industrial education, who assisted in the establishment of prevocational and vocational courses, organized upon the basis of the survey findings and recommendations.

5. The United States Bureau of Labor Statistics. This bureau's expert on industrial education was given six months' leave of absence, to enable him to serve as Director of the Industrial Survey. The Bureau of Labor Statistics, also, is to issue the full report of the findings and recommendations, which will probably run to 300 pages or more and will include the four large text-charts, a few copies of which, by the courtesy of the Bureau, I have been permitted to bring to this meeting for distribution in case any members present care to have them. The Bureau, by assuming the cost of printing these charts and the full report, has made possible the publication of both the charts and the report in the proposed form. The chief editor of the Bureau, Mr. Verrill, has served upon the editorial committee of the survey and through him and Commissioner Meeker the Bureau has coöperated to the full extent of its authority to do so.

Another department of the federal government may be mentioned as being implicated indirectly in the undertaking—the Department of Commerce—since Secretary Redfield of that Department is President of the National Society for the Promotion of Industrial Education. The Commissioner of Labor Statistics and the Secretary of Commerce manifested their interest in the work by attending the convention held in Richmond to consider the findings of the survey and by participating in the proceedings.

It may be of interest to note, also, since there has been some misunderstanding as regards the attitude of organized labor with reference to the institution of industrial education even in the public schools, that in the work of gathering the data the agents of the survey had the full coöperation of the local labor unions, and that Mr. Gompers, President of the American Federation of Labor, also attended the convention in Richmond and in an address heartily endorsed the proposed program.

The character of the data gathered relating to occupations may be inferred from the charts, which present in parallel

columns a statistical analysis of some 56 occupations in the printing, building, and metal trades, and in the tobacco industry. Occupations in retail stores are included in the report, but have not been charted. The report contains, also, the full analysis of each occupation briefly summarized on the charts, together with a very considerable amount of tabular matter and general text dealing with the industrial character of Richmond.

The data for the charts and for the tabulations were gathered upon schedules and through personal interviews with employers and employees.

The schedule inquiries related to such topics as hours, wages, seasonal fluctuation, age of entrance to trade, extent to which the trade could be learned in the shop, years required to learn the trade, age period of maximum productivity, source of labor supply, the demand for labor and whether the demand is increasing or decreasing in Richmond; the conditions of employment that involve physical or nervous strain, that stimulate or that narrow or restrict development, or are in other respects important as affecting the welfare of the worker; the requirements as regards general, trade, and technical education of the worker; the line of promotion in the shop; provision made in the shop for systematic instruction of apprentices and of journeymen; the common deficiencies of workers; what training the school ought to give the boy or girl before he enters the shop; what it ought to give for the apprentice and for the journeyman in the shop, by means of continuation classes; and other facts of importance in constituting a statistical basis for organizing industrial education.

The charts summarize briefly a portion of the data gathered on these schedules and from other sources. In the case of each occupation shown, the analysis begins with a brief description of the nature of the occupation itself and continues down the column covering the points which have been specified.

Consistently with the purpose of the industrial survey—*i. e.*, to provide a basis of statistical information relating to industrial occupations in the city of Richmond upon which to base a system of industrial education in the public schools—and

while the work was still in progress, courses were organized, in response to requests coming from the workers themselves, for molders, plumbers, electricians and for workers in other occupations.

It is assumed as a principle justifying such surveys that industrial education must be intimately related to specific local industrial needs—that it must be based upon data relating not to occupations in general, but to occupations as determined by the industrial developments of the community in which that sort of education is undertaken—taking account, for example, of the extent to which processes and employments in the given community have been specialized. In the survey of Richmond's building trades, for example, some fifteen distinct occupations could be defined, but if the survey had been in New York city, the number of distinct occupations in the building trades would have been very much greater. In Richmond the carpenter may have occasion infrequently to lay a parquet floor, in New York, the parquet-floor layer may not be required even occasionally to do any other sort of work. In general the needs of Richmond, as regards industrial education, are local and peculiar, and the industrial courses established in Richmond should, therefore, be unique, reflecting the industrial character of the community and being modified and developed as the local industries change. In accordance with this principle, the data upon which to base industrial education in any community must be gathered in the workshops of that community. This makes the basis of industrial education empirical and statistical. It makes the problem of industrial education essentially a local, municipal problem. It assumes that no system of industrial education devised for one community is adapted to the needs of any other community.

If the problem of industrial education is so essentially local in character, what interest has the federal government in the character of Richmond's industrial education? The answer is of course obvious. No social problem is purely local, and while industrial education must, if it is to be efficient, be differentiated locally, it is, nevertheless, in the aggregate a national affair. The federal government, representing the

country as a whole in its industrial development and competition with foreign nations, is interested in the extension of practically efficient industrial education as a national asset, just as Richmond, in its industrial development in competition with other cities, is interested in the development of practically efficient industrial education as a municipal asset.

Formal coöperation, such as has been outlined, between public and private agencies in the actual field work of statistical inquiry, may seem somewhat inconsistent, not only with official dignity, but with the general principle that public agencies must not engage in private enterprises. This appearance of inconsistency arises from a failure to recognize that private associations may be engaged in work which is clearly affected with a public interest. Where this is the case coöperative participation of federal bureaus in rendering statistical service is entirely proper as a public function. The extent to which government bureaus can coöperate with private agencies in statistical work is obviously limited to such enterprises as are clearly affected with a public interest, and in general the possibility of coöperation is determined by the character of the private agencies.

The number of responsible, permanent private foundations and associations which represent important social interests is very considerable and is increasing. These private organizations have arisen in response to recognized social needs. Immigrants stranded in our large cities, for example, constitute a social problem, and a League for the Protection of Immigrants is organized. The need for industrial education becomes pressing and a society for the Promotion of Industrial Education is organized. Conservation of soil, water-power, and forests is the basis of private associations. In a word, every important social need is bound, sooner or later, to become the basis of organization. Such organizations are national in character, they represent national interests, and where the purposes of these organizations are consistent with the public interest, coöperative participation by bureaus of the federal government in the work which they are doing, would seem to be a natural procedure.

Incidentally it may be noted that the difficulties in the way

of such coöperation are in some respects less considerable than in the case of public agencies. Public agencies, state or municipal, are essentially local—essentially not national in character. Every public agency has its geographic field of operation defined in ordinances and statutes. Such agencies, moreover, operate under a rigid legal definition of powers and functions, which in many instances constitutes a barrier to effective coöperation.

In the case of private agencies there is no rigidity of legal status to be broken down. It may be noted, further, as a justification for coöperation with private agencies that they, more frequently than public agencies, represent specific social problems, national in scope—that they represent live interests which have developed in the community—that they represent what the community is thinking about; whereas the public agency or bureau represents a traditional interest as defined in more or less permanent statutes and ordinances. The private agency may infuse inspiration and motive into official routine.

The advantages of coöperation in the instance which has been noted will be obvious, and it will, I think, be clear that equally great advantages may result from similar coöperation in other lines of work where permanent, responsible, private agencies are in the field.

All of the work on the Richmond survey was done under the direction of professional experts, who prepared the schedules, and supervised the field work and the tabulation of the data. Such work, if it is to be of value, must be done by professionals, and it will be obvious that cities generally cannot maintain corps of experts for this work, since in the nature of the case the work is not, as regards any single city, continuous.

This is the condition which perhaps more than any other makes coöperation of the federal government essential. A municipality undertaking such work independently may find it necessary to depend upon inexperienced service. Without coöperation, each survey is experimental and the data gathered relating to occupations and industries in different cities are bound to be of varying value and character.

As regards the country as a whole, however, assuming that cities generally undertake such surveys, the work is continuous, and bureaus of the federal government can, therefore, organize on a permanent basis for the promotion of such undertakings.

While the statistical analysis of occupations undertaken in Richmond was undertaken for the specific purpose of providing a basis of industrial education in that city, the data gathered are of general economic significance, being such as must to a greater or less extent underlie economic speculation regarding industrial conditions and employments. The significance of the data will, obviously, increase in proportion as the number of cities covered increases, and in proportion as the work is organized and conducted in accordance with some uniform scheme. Coöperation of the federal bureaus would seem to be an obvious way of securing this uniformity in method and data.

Finally, it is of importance that the schedules used in such work shall be subjected to scientific criticism and that they shall be perfected so as to get the data which are of economic value. The Richmond survey is the first of its kind and is necessarily in this respect experimental. It is intended to serve as a type survey, but even while the work was in progress those engaged in the work realized that improvements could be made in the methods and in the schedules, and when the report issues from the Bureau of Labor Statistics, it is to be hoped that criticisms will be freely forthcoming from those interested to secure accurate data regarding the common industrial pursuits of wage-earners.

SOME PRESENT STATISTICAL NEEDS AND THE STATISTICAL WORK OF THE FEDERAL GOVERNMENT.*

By W. S. Gifford, *Statistician, American Telephone and Telegraph Co.*

I wish to speak on the subject of Some Present Statistical Needs and the Statistical Work of the Federal Government. I mention *present* statistical needs merely to remind you that it is not only possibly but probably a fact that the statistical needs of today differ somewhat from those of a not far-distant yesterday.

My time is too limited to bring evidence to prove this point, but the story of changed conditions of industry and the growth of large undertakings in business and social fields, with the resulting increased necessity for up-to-date statistics, has been so often told that it does not need repeating. The Federal Reserve Board, the new Industrial Trade Commission, and the United States Commission on Industrial Relations are instances of new federal bodies that will have to rely largely upon statistics in their work. The private organizations and societies and large business undertakings which must so rely are becoming almost innumerable. These recent developments mean that the field of the economist and the statistician has been extended and that work somewhat similar to that previously done by the academic economist or statistician is now being done as a practical every-day affair by men by no means exclusively specialists in economics or statistics.

How then does the present statistical work of the federal government meet these rather new requirements? As in the past we still have the academic requirements and the needs of the specialist and student. That the statistical work of the federal government largely meets these academic requirements, there seems to be little or no question. While it is useful to a degree in meeting the newer practical require-

* Remarks before the American Economic Association and the American Statistical Association, at Princeton, N. J., December 30, 1914.

ments, these requirements are so important that they deserve careful consideration.

In the first place, when information on a given subject is desired, it is essential to know promptly just what is already available without the necessity of too much specialized knowledge of all possible sources, as to just how much along the lines in question has already been done. Otherwise, much time and expense may be wasted in duplicating information already collected or, what is still more serious, important decisions may be made more or less by guess, which decisions might have been based on facts already compiled. To find out what the federal government with its many departments and diversified interests has to supply in the way of statistics is, at present, to the ordinary busy man a complicated and difficult task. This statement may seem strange to the specialist who has become thoroughly acquainted with the duties and work of the federal government and with the various sources of information which there are at present regarding that work.

What I plead for, however, is a subject index which could be published from time to time, furnishing a convenient source of information for all the statistical data available in the various departments of the federal government. This should, of course, be kept up-to-date, by, say, monthly bulletins and periodical revisions of the complete index.

Parenthetically, I cannot pass this thought by without suggesting that a subject index of statistical information, available not only in the federal government but in state, municipal, and private fields, although it would be a colossal undertaking, would in its results more than justify its expense.

As I said before, many people today use statistical information who are not students or specialists. Now this idea presents another need. These are busy people in their particular work, whatever it may be; they look in a document for certain figures and they do not always read the text which explains those figures. It is, therefore, important to prevent serious mistakes that all tabular statements of figures should be self-explanatory; *i. e.*, the limits of the use of the figures in the table should be shown by either the heading of the table or a footnote. If absolutely necessary, the footnote could

refer to certain pages of the text with a statement that the figures should not be used for any purposes without first having read the text.

Again, the question of speed is important, for figures become less valuable for many purposes in direct proportion to the remoteness of the date of which they are representative. Tables first, with only the essential text issued promptly, and analytical analyses issued later might well be the standard method.

Lastly, I would say a word about the adaptation of the kind of statistics prepared to the kind of statistics needed. Anything which can be done to further improve the direct relation between the men who use the statistics and the government department which collects them would be decidedly worth while. We are discovering every day that we want statistics of a sort which we have not yet gathered. It is, furthermore, possible that we are gathering statistics of a sort which we no longer need. If there were formed a standing committee or, better still, an official commission of some sort with representatives of such associations as the American Economic Association and the American Statistical Association, together with, let us say, the American Bankers Association, the Chamber of Commerce of the United States, etc., and representatives of the government statistical departments, it would be to the advantage of us all. It would provide a definite opportunity for us to present such statistical needs as our own individual experience develops to a body which would be able to take some practical action in the matter.

It is a fact that a great deal has been done and is being done along these various lines but perhaps still more can be done to hasten them along to a satisfactory conclusion. There can be no question as to the need of having them ultimately worked out.

Briefly, then, present statistical needs require of the federal government:

1. A subject index of all statistical data available.
2. Statistical tables that are self-explanatory.
3. Greatest practical speed.
4. Some organization, composed of government and private individuals, to assist in adapting the kind of statistics gathered to the kind of statistics needed.

CONCERNING UNIFORM INTERNATIONAL FINANCIAL STATEMENTS.*

By Harvey S. Chase, S. B., C. P. A., *Boston, Mass., and Washington, D. C.*

Mr. Chairman and Members of the Associations:—In order to comply closely with the excellent rule of your managing committee which restricts the time allowed to each speaker at this discussion, I must present at once certain conclusions which I have reached upon the topic of this discussion and leave for another time the explanations of why and how I was led to these conclusions.

The suggestion embodied in the title of this address came to me from Dr. S. N. D. North of the Carnegie Endowment for International Peace and I have been permitted by Dr. North to see the correspondence with officials of the "International Statistical Institute," whose permanent headquarters are at The Hague and whose last international meeting was held at Vienna in August, 1913. This correspondence has in view a possible working coöperation between the Carnegie Endowment and a Committee of the International Statistical Institute, or other eminent statisticians, for the purpose of developing a plan for the compilation of uniform international financial statistics; in other words, to establish what the world has long needed, a basis for an international budget.

The Institute officials, particularly Dr. Zahn of Munich, have been interested for years—even so far back as 1853—in questions relating to standard schedules for uniform financial statements by all nations. Much hard work and profound thinking has been done by Dr. Zahn and others upon *pro forma* drafts for such schedules.

It is evident, however, to me, after some fifteen years' experience in establishing uniform financial statements for municipalities, for states, and for the national government, that these preliminary drafts have been somewhat too ambitious,

* Remarks before the American Economic Association and the American Statistical Association at Princeton, N. J., December 30, 1914.

much too extended and detailed, for the immediate practical purpose. It seems to me that it is necessary, if results are to be attained which will justify the labor and expense involved, that attention should be concentrated at first upon relatively few, fundamental classifications, leaving others—even the finer details of these fundamental classes—to be worked out later in the natural course of development. By this I mean that if we wait for a perfect theoretical system to be devised, including all the detailed subdivisions necessary to embrace the requirements for every nation, we will, owing to the magnitude and the diversity of purposes, methods, and accounts of the various nations, postpone for years the beginning and final accomplishment of our desire, namely: to obtain comparisons of governmental costs in those nations.

On the contrary, if we are content to exhibit only large, fundamental functions in our first classification, we may reach important results almost immediately, and thereafter we may subdivide and reclassify these results according to the increase of our knowledge of the facts and as the awakening interest of the statisticians of the nation will provide.

This course was the one pursued in municipal affairs in this country. First, in 1899, one city—Newton, in Massachusetts—adopted the socalled "Uniform Classification of Municipal Expenditures" which had been prepared by a committee of the National Municipal League. As soon as the annual report of that city was published and it became evident that even one city had adopted the classification, the latter took on a practical character. Other cities adopted it of their own motion or under supervision of the League's committee and within two years a whole state, Ohio, had applied it to all her cities, eighty in number. Then New York adopted it in somewhat improved form and Massachusetts followed, applying the uniform classification to all her cities and to all her towns so far as their annual reports to the Commonwealth were concerned. The United States Census, Division of Wealth, Debt and Taxation, took it up and soon there was developed workable and uniform classifications of municipal expenditures and revenues which were applicable to any and to all cities throughout the country.

Now, prior to the practical application in Newton, the National Municipal League had been debating the form of standard classification for some years without results, for the reason that no two people could agree, or can agree, upon all of the elements of any detailed classification. Some will favor one location and some another location for the same function or item. The disagreements are without end, the disputants seldom if ever reach a conclusion upon these theoretical details. For example, if we had not immediately tried out the classification at Newton, just as it was, in 1899, it is possible that the various contestants would be discussing yet, whether "Hospitals" should be associated with "Charitable Institutions" or with "Conservation of Health" and whether "Cemeteries" should be classed as sanitary measures or as "Public Utilities." Therefore the important thing is to get the movement started in practice on a simple but fundamental classification, which can be agreed upon promptly by a majority of those who have expert knowledge of the subject.

What appeals to me concerning the present matter-in-hand is this:—That a committee of the Statistical Association or of the Economic Association or, better, of both combined, should be appointed. Not too large a committee, but one whose members can meet conveniently and regularly and thereby accomplish definite results within a relatively short time. This committee should adopt, after proper discussion, a preliminary classification of national functions with such subdivisions as may be deemed practicable and then the new budget of the United States of America for 1915–16 should be drawn up by the committee and published in accordance with these classifications at the earliest possible moment—not a year or two hence but right off now, within two months or three at the outside. Then, the practicability of the classification having been established through adjustments made during this experience, the published results should be spread broadcast in this country and abroad for criticism, suggestion, and imitation. The committee, also, should be authorized to consult and coöperate with foreign committees, which have been, or may be, appointed for the same purpose.

Now, what are the fundamental functions common to all, or nearly all, the nations? Evidently—we have the proof before us—"War," or "National Defense," is one of them; the most important single function of them apparently. What is another? Evidently national "indebtedness" is another; to wit:-debts, sinking funds, interest, all matters relating to national debts, funded or floating. Again, national "administration" is universal in some form. The legislative, executive, and judicial functions are everywhere present. They can be classified without serious difficulty; by this I mean the higher administration, the "overhead" costs of national government.

So far we have mentioned three large, fundamental functions, national defense, national indebtedness, and national administration, each capable of simple subdivisions of uniform and standard character. With these three we shall have covered much more than half, probably three quarters, or even more, of the total costs of each national government. We may well be satisfied with these three if it should prove impracticable to advance further this year. I am convinced, however, that we shall find that we can advance quite a little further almost immediately. For instance, there are the "public service" or "public utility" functions, such as railroads, telegraphs, telephones, mail service, and express service. Also there is forest service, and agriculture, as well as commerce, and various other functions which can be classified, in big subdivisions at least, and which will be fairly comparable among the nations. Soon, however, we would get into serious difficulties and would be obliged to stop, for the present.

"To stop" reminds me that my time is expiring and therefore I desire to suggest to you the advisability of the appointment of a joint committee, such as has been outlined, to consist of, say, six persons, one-half from each Association. This committee should be instructed to take hold immediately of our subject and prepare the fundamental classifications promptly. If such a committee does its work effectively, the results should be of great importance and the work should be a means of gratification to the members of both of your learned bodies in the future.

APPENDIX.

EXHIBIT OF ONE SIDE OF THE NATIONAL BUDGET, THE "EXPENDITURE" SIDE ONLY; NOT INCLUDING THE "REVENUE" SIDE.

Prepared by Harvey S. Chase, C. P. A., from the "Book of Estimates" of each year, which is published by the Treasury Department, U. S. A.

UNITED STATES OF AMERICA.

The National Budget on the Expenditure side, Based upon the "Estimates" submitted to Congress by the Departments and Offices for the Current Fiscal Year ending June 30, 1915, and for the New Fiscal Year ending June 30, 1916.

Classified by Purposes of Expenditure (Functions of Government).

GENERAL SUMMARY. TOTAL ESTIMATES.

	Fiscal Year 1914–15.			Fiscal Year 1915–16.		
	Operation and maintenance expenses.	Construction and improvement outlays.	Total estimated expenditures.	Operation and maintenance expenses.	Construction and improvement outlays.	Total estimated expenditures.
A. Totals for "War" Functions (National Defense) excluding sinking-fund estimates	$409,286,834	$56,895,356	$466,182,190	$397,204,573	$61,867,230	$459,071,803
B. Totals for "Peace" Functions (Social and Economic) excluding Postal and sinking-fund estimates	110,074,651	79,239,444	189,314,095	123,806,137	72,500,130	196,306,267
C. Totals for Postal Service	308,803,117		308,803,117	299,175,859		299,175,859
D. Totals for General Governmental Functions	61,839,638	6,698,084	68,537,722	59,760,946	2,413,025	62,173,971
E. Totals for Local Governmental Functions	11,547,132	3,580,521	15,127,653	10,751,495	2,572,739	13,324,234
Grand Totals, all purposes, except sinking-fund	$901,551,372	$146,413,405	$1,047,964,777	$890,699,010	$139,353,124	$1,030,052,134
"Sinking-fund" estimates, having no validity*	$60,717,000		$60,717,000	$60,723,000		$60,723,000
Grand Totals, per "Book of Estimates"	$962,268,372	$146,413,405	$1,108,681,777	$951,422,010	$139,353,124	$1,090,775,134

* Sinking-fund provisions are negligible; merely bookkeeping items having no actual existence. There are no securities and no cash in the so-called "sinking-fund."

A. EXPENDITURES FOR "WAR" OR NATIONAL DEFENSE FUNCTIONS.

ARMY. NAVY. WAR PENSIONS. WAR DEBTS.

	Fiscal Year 1914–15.			Fiscal Year 1915–16.		
	Operation and maintenance expenses.	Construction and improvement outlays	Total estimated expenditures.	Operation and maintenance expenses.	Construction and improvement outlays.	Total estimated expenditures.
ESTIMATES FOR COSTS OF PRESENT-DAY NATIONAL DEFENSE						
Current Charges. Annual Appropriations. (1)						
Defense by land (Military)	$100,249,712	$14,379,198	$114,628,910	$93,447,100	$15,943,824	$109,390,924
Administration: Secretary of War	148,040		148,040	146,440		146,440
Adjutant-General's Office	730,570		730,570	724,870		724,870
Quartermaster Corps	378,670		378,670	376,620		376,620
Engineers and Insular affairs	208,581		208,581	206,290		206,290
Other offices, War Dept	456,598		456,598	453,878		453,878
Defense by sea (Naval)	98,311,306	42,490,734	140,802,040	96,558,480	45,332,801	141,891,281
Administration: Secretary of the Navy	76,460		76,460	83,580		83,580
Bureaus: Navigation, Intelligence, Records	108,790		108,790	110,790		110,790
Bureaus: Engineering, Repairs, Yards and Docks	106,430		106,430	128,430		128,430
Bureaus: Supplies, Accounts and other offices	304,660		304,660	273,740		273,740
Operation and maintenance ([1]) of the State, War and Navy Building (2)	188,013	2,000	190,013	105,227	8,000	113,227
Totals for current national defense	$201,267,830	$56,871,932	$258,139,762	$192,615,445	$61,284,625	$253,900,070
ESTIMATES FOR COSTS AT PRESENT OF PREVIOUS WARS						
Current Charges. Annual Appropriations.						
War pensions, retirements, veterans' homes, etc	186,674,527	23,424	186,697,951	183,419,651	582,605	184,002,256
Totals for current charges, war functions	$387,942,357	$56,895,356	$444,837,713	$376,035,096	$61,867,230	$437,902,326
Fixed Charges. Permanent Appropriations. (1)						
Interest on war debts	13,000,000		13,000,000	13,000,000		13,000,000
Sinking-fund provisions for war debts (3)	37,000,000		37,000,000	37,000,000		37,000,000
Trust funds, established by war requirements	2,770,000		2,770,000	2,730,000		2,730,000
Special funds and accts. for war purposes	5,574,477		5,574,477	5,439,477		5,439,477
Grand Total for "War" Functions	$446,286,834	$56,895,356	$503,182,190	$434,204,573	$61,867,230	$496,071,803
Deduct "sinking-fund" (3)	37,000,000		37,000,000	37,000,000		37,000,000
TOTAL ESTIMATES FOR ACTUAL "WAR" FUNCTIONS	$409,286,834	$56,895,356	$466,182,190	$397,204,573	$61,867,230	$459,071,803

(1) These terms "annual" and "permanent" might be better stated "current" and "recurrent," as all appropriations are enacted annually by Congress, even though the amount is not fixed (indefinite), or the time is not fixed (indeterminate).

(2) Operation and maintenance expenses of office buildings, rents, etc., are mainly included in item "operation and maintenance of public buildings" General Governmental Purposes, because these expenses cannot be separated, under present methods of bookkeeping.

(3) Sinking-fund provisions are negligible; merely bookkeeping items having no actual existence. There are no securities and no cash in the so-called "sinking-fund."

(4) See additional estimates under "permanent appropriations."

(5) Including Bureau of Naturalization, $250,000 in 1914–15, and $307,950 in 1915–16.

(6) This amount should be distributed in detail to the various departments and divisions.

(7) Approximately one-half of this is offset by District of Columbia revenues.

(8) Panama Canal is included in "Peace" estimates although a good case can be made out for including it, or a large portion of its cost, under "War" estimates. In both years, however, certain fortification estimates are included under war functions.

B. EXPENDITURES FOR "PEACE." CIVIL, SOCIAL, AND ECONOMIC FUNCTIONS.

STATE, INTERIOR, AGRICULTURE, COMMERCE, LABOR, ETC.

	Fiscal Year 1914–15.			Fiscal Year 1915–16.		
	Operation and maintenance expenses.	Construction and improvement outlays.	Total estimated expenditures.	Operation and maintenance expenses.	Construction and improvement outlays.	Total estimated expenditures.
Current Charges. Annual Appropriations. (1)						
I. Natural Resources, Agriculture, Etc.						
1. Promotion of agriculture (4)	$8,951,617	$47,500	$8,999,117	$10,562,555	$6,750	$10,569,305
2. Promotion of mining, topography, regulation of water power, etc.	2,284,520		2,284,520	2,345,230	3,000	2,348,230
3. Promotion of forestry	5,390,741	477,590	5,868,331	5,386,256	467,000	5,853,256
4. Promotion of fisheries	1,155,730	255,900	1,411,630	1,096,084	203,400	1,299,484
5. Care and utilization of public lands	3,184,920	10,000	3,194,920	3,098,824		3,098,824
6. Meteorological research, weather bureau, etc.	1,667,270	3,000	1,670,270	1,703,750		1,703,750
7. Statistical research, census, etc.	1,709,720		1,709,720	4,342,540		4,342,540
II. Commerce, Banking, Etc.						
1. Regulation of currency, coinage, etc.	5,862,452		5,862,452	6,213,874		6,213,874
2. Promotion and regulation of commerce	3,578,305		3,578,305	3,406,585		3,406,585
3. Regulation of Standards of measurement, etc.	837,175	395,000	1,232,175	781,355	256,000	1,037,355
4. Promotion of transportation: (4)						
Improvements of rivers and harbors	3,197,815	38,286,080	41,483,895	7,721,435	45,665,788	53,387,223
Lighthouses, life saving, roads, surveys, engineering, etc.	12,484,004	2,679,700	15,163,704	12,509,057	2,454,000	14,963,057
Panama Canal (8)	1,546,395	22,228,760	23,775,155	6,429,197	10,512,440	16,941,637
5. Regulation of banking	194,240		194,240	216,740		216,740
6. Regulation of patents and copyrights	1,626,300		1,626,300	1,584,050		1,584,050
III. Welfare, Labor, Etc.						
1. Promotion of public health (4)	4,087,062	104,700	4,191,762	4,425,188		4,425,188
2. Promotion of education and recreation (4)	1,349,376	1,271,014	2,620,390	1,345,792	953,708	2,299,500
3. Promotion of the welfare of the laboring classes and regulation of labor (5)	4,068,250	812,200	4,880,450	3,986,150	382,000	4,368,150
4. Provisions for Indians and wards of the Nation (4)	9,295,715	1,635,400	10,931,115	9,449,013	706,000	10,155,013
5. Provision for defectives, dependents, etc.	1,565,349	455,000	2,020,349	1,466,356	3,000	1,469,356
IV. Foreign Affairs.						
Foreign affairs and relations (4)	3,920,970	477,000	4,397,970	4,539,766	23,044	4,562,810
V. Departmental Administration						
1. Administration; Dep't of State	354,060		354,060	378,580		378,580
2. " " " Interior	634,040		634,040	635,850		635,850
3. " " " Agriculture	765,988		765,988	896,287		896,287
4. " " " Commerce	252,160		252,160	300,220		300,220
5. " " " Labor	183,040		183,040	165,060		165,060
6. Operation and maintenance, (½) State, War and Navy Building (2)	94,007	1,000	95,007	52,613	4,000	56,613
	$80,241,221	$69,139,844	$149,381,065	$95,038,407	$61,640,130	$156,678,537

Fixed Charges. Permanent Appropriations. (1)						
I. Interest on bonds, other than for war purposes	$9,900,000		$9,900,000	$9,970,000		$9,970,000
II. Sinking-fund provisions for other than war purposes (3)	23,717,000		23,717,000	23,723,000		23,723,000
III. Trust funds provisions for other than war purposes	7,772,730		7,772,730	7,638,500*		7,638,500
IV. Special funds and accounts for "social and economic" functions,—Viz:						
1. Promotion of Agriculture:						
Co-operative agricultural extension work				$1,080,000		$1,080,000
Reclamation of arid lands		$9,000,000	$9,000,000		$9,000,000	9,000,000
Colleges of agriculture and mechanic arts	$2,500,000		2,500,000	2,500,000		2,500,000
Experiment stations, etc.	48,200		48,200	71,000		71,000
2. Promotion of transportation facilities:						
Operating canals	2,000,000		2,000,000	2,000,000		2,000,000
Protection of navigable streams	2,000,000		2,000,000	100,000		100,000
River and harbor improvements		679,600	679,600	274,600	1,500,000	1,774,600
Roads and trails		420,000	420,000	52,400	360,000	412,400
3. Medium of exchange:						
National currency, contingent expenses, etc.	280,000		280,000	280,000		280,000
4. Promotion of public health:						
Meat inspection, Bureau of Animal Industry	3,000,000		3,000,000	3,000,000		3,000,000
5. Promotion of education, recreation, etc.:						
National forest fund	600,000		600,000	600,000		600,000
2, 3 and 5 per cent. funds to States	225,000		225,000	125,000		125,000
Maintenance national parks, etc.	125,000		125,000	100,000		100,000
Public schools, territories	100,000		100,000	95,000		95,000
Education of blind, etc.	11,000		11,000	10,000		10,000
6. Care of Indians:						
Civilization of the Sioux	800,000		800,000	600,000		600,000
7. Care of defectives:						
Indigent, Alaska	25,000		25,000	25,000		25,000
8. Foreign affairs:						
Pay of consular officers in transit	65,000		65,000	65,000		65,000
Pay of consular officers, services, vessels, etc.				5,000		5,000
Totals of special funds and accounts	$11,779,200	$10,099,600	$21,878,800	$10,983,000	$10,860,000	$21,843,000
V. Other permanent appropriations for "social and economic" functions	381,500		381,500	176,230		176,230
Totals for Peace Functions (except Postal)	$133,791,651	$79,239,444	$213,031,095	$147,529,137	$72,500,130	$220,029,267
Deduct "sinking-fund" (3)	23,717,000		23,717,000	23,723,000		23,723,000
TOTALS, LESS SINKING-FUND, FOR "PEACE"	$110,074,651	$79,239,444	$189,314,095	$123,806,137	$72,500,130	$196,306,267

* $6,600,000 of this are for Indian trust funds. Other footnotes on p. 457.

C. EXPENDITURES FOR POSTAL PURPOSES.

	Fiscal Year 1914–15.			Fiscal Year 1915–16.		
	Operation and maintenance expenses.	Construction and improvement outlays.	Total estimated expenditures.	Operation and maintenance expenses.	Construction and improvement outlays.	Total estimated expenditures.
ESTIMATES FOR POSTAL SERVICE						
1 Postal service, payable from postal revenues	$306,953,117		$306,953,117	$297,355,164		$297,355,164
2. Administration of Postmaster-General's Dept	1,850,000		1,850,000	1,820,695		1,820,695
3. Operation and maintenance of post offices, etc. (2)						
TOTALS FOR POSTAL SERVICE (2)	$308,803,117		$308,803,117	$299,175,859		$299,175,859

D. EXPENDITURES FOR GENERAL GOVERNMENTAL FUNCTIONS.

Covering requirements both for purposes of war and for purposes of peace.

LEGISLATIVE, EXECUTIVE, JUDICIAL, ETC.						
Current Charges, Annual Appropriations (1)						
I. Legislative:						
The United States Senate	$1,849,287	$8,500	$1,857,787	$1,858,217	$5,000	$1,863,217
The House of Representatives	4,956,985		4,956,985	5,020,977		5,020,977
II. Executive:						
The President, Vice President and the executive offices	210,440		210,440	211,840		211,840
Civil Service Commission	450,165	5,000	455,165	466,085		466,085
Collection of the revenues, etc.—Treasury	17,247,650	125,000	17,372,650	17,034,460	50,000	17,084,460
General accounting and auditing—Treasury	1,752,080		1,752,080	1,765,930		1,765,930
Operation and maintenance of public buildings and grounds (2)	8,098,412		8,098,412	7,345,354		7,345,354
Construction and improvement of buildings and grounds		6,302,584	6,302,584		2,130,525	2,130,525
Public printing, all departments (6)	5,892,408	130,000	6,022,408	5,000,885	100,000	5,100,885
General Supply Committee	65,640		65,640	42,090		42,090
Reference and library purposes	465,585	127,000	592,585	354,740	127,500	482,240
Distribution of documents	318,275		318,275	329,765		329,765
Administration of Treasury Dept.	1,890,770		1,890,770	1,796,520		1,796,520
Administration of Dept. of Justice	777,711		777,711	622,143		622,143
Detection of crimes, legal advice, etc. (Justice)	2,694,620		2,694,620	2,592,560		2,592,560
III. Judicial:						
The Supreme Court and other courts	6,299,110		6,299,110	6,453,380		6,453,380
Fixed charges. Permanent Appropriations (1)						
Revenue refunds, drawbacks, etc.	8,470,000		8,470,000	8,490,500		8,490,500
Retired judges, Hawaiian judges, etc.	175,500		175,500	175,500		175,500
Revenue Collection, night services	225,000		225,000	200,000		200,000
TOTALS FOR GENERAL GOVERNMENTAL FUNCTIONS	$61,839,638	$6,698,084	$68,537,722	$59,760,946	$2,413,025	$62,173,971

E. EXPENDITURES FOR LOCAL GOVERNMENTAL FUNCTIONS.

Territorial Governments	$304,638		$304,638	$233,800		$233,800
Philippine customs and internal revenue	321,000		321,000	181,000		181,000
District of Columbia (7)	10,911,094	$3,580,521	14,491,615	10,336,695	$2,572,739	12,909,434
Militia, industrial schools, etc.	10,400		10,400			
TOTALS FOR LOCAL GOVERNMENTAL FUNCTIONS	$11,547,132	$3,580,521	$15,127,653	$10,751,495	$2,572,739	$13,324,234

Footnotes on p. 457.

INTERNATIONAL COÖPERATION FOR THE STANDARDIZATION OF STATISTICAL WORK.*

By Roger W. Babson.

As Mr. Chase has so ably suggested, some of us are much interested in certain plans for standardizing and jointly publishing certain international statistics of which statesmen and business men are so much in need. We further believe that the development of the statistical work of the United States Government has reached a point where to longer go ahead without regard to what other nations are doing will mean a lot of undoing later.

In view of the fact that President Koren has given me a place upon this program to tell about this work, I feel that the least I can do is to reciprocate by basing the first half of my remarks upon a most able paper upon the subject which he read last year in New York. Our argument in brief is as follows:—

"For years it has been the hope of statesmen and economists, as well as of statisticians, that the censuses of the principal countries of the world might become so standardized that it will be possible to make accurate comparative studies of the true growth and relative prosperity of the respective nations. It has not been contemplated that the national censuses should follow the same pattern in all details, but that they should deal with specified subjects in a certain uniform manner, such subjects to be chosen as will afford a fact-basis for determining the economic and social standing and development of each nation.

"The possible utility of a world standard of values as applied to nations is infinite. The interdependence of nations in things that make for prosperity and general well-being is daily becoming more obvious. Back of much of the insecurity and strife in international commerce and industry, back of the halting way in which we endeavor to meet common social

*Paper read at the joint meeting of the American Economic Association and the American Statistical Association, Princeton, N. J., December 30, 1914.

problems, back of the international jealousies and suspicions that always threaten, lurks ignorance of national and international conditions and relations. It is the ability to strike a reliable balance sheet that has made possible the huge systems of combinations in commerce and banking. Is not the use of a balance sheet equally urgent in the affairs of nations if they shall be directed for the common good of all?

"Of the many by-products to be derived from standardizing knowledge in the manner indicated, how it will point to opportunities in business, prevent losses through foreign investments and commercial dealings, how it may help to a better distribution of population as well as products of agriculture and industry, how it may reveal fundamentals in educational systems that make for real prosperity, there is not time to speak."

The idea of a Standard International Census has had many advocates within bodies like the International Statistical Institute, and the International Agricultural Institute at Rome. Recently, at various gatherings here and abroad and through publications, the idea has won new momentum. Everywhere it meets hearty approval. Boards of trade, producers and bankers, no less than statisticians, economists, and peace advocates, readily see its wide bearings.

Of course, such a development in statistics will not be brought about at once. One feature, however, can be taken up at a time and a beginning made very soon. Mr. Chase has shown the need of standardizing the budgets of the leading nations, and other members of our associations have at times pleaded for conformity in other statistical work. One specific illustration is the work being done by Professor Irving Fisher, for standardizing the Commodity Prices Indices of the different nations. Very important fiscal, industrial, and social movements are absolutely held up for lack of scientific and comparable figures on the cost-of-living.

Mr. Meeker has referred this morning to the great work which he is doing toward setting our own house in order, and yet he is being forced to do this independent of any help from other nations, which makes it almost certain that some day it must all be done over again. The same condition of affairs

exists in connection with our figures on exports, imports, and a host of other subjects. Every conscientious governmental official is up against the same problem that Mr. Meeker is, while the bankers, manufacturers, and merchants of the country are all at sea.

But some say: "Why trouble about so-called international statistics until we get better national statistics? Why try to standardize the statistics of the world until we standardize those of our own country? Why attempt to make England, Germany, and the other great nations conform to the same methods of compilation until we get California, Illinois, and Massachusetts to agree?" At first thought these questions seem reasonable, but there are good answers to them all. First, the very time to standardize such statistics is before they are "perfected" in the different countries. The more incomplete they are, the easier it will be to induce the different nations to adopt the standardized forms. The longer the change is delayed, the more difficult it will be to get them to make the much desired changes. Second, it would be very much easier to perfect the compilation and methods used by the different states of our own country if we had some international standard to refer to. California may not want to change her system to please Massachusetts or to copy a standard set by Illinois, but she could be much more readily induced to adopt some international standard prescribed by an international commission.

Members of the American Statistical Association and members of the American Economic Association: This seems like a large order, but the statistical work of the United States Government, to be of real value, depends upon the placing and the filling of such an order.

But since our last meeting something has happened which may very much help in this development. I refer to the great European war. In closing, I wish to say a word about this development. From reports which I am receiving from Europe, two probabilities are now apparent concerning the war in Europe. One is that the war will be called off before many months with neither side vanquished; and the other is that it may result in some sort of a commercial alliance which will

assure equal protection to the commerce and markets of all nations.

The Hague Tribunal, which has been the work of pacifists and jurists, has signally failed. We have learned that little progress can be made for world peace through sentimental plans for arbitration. We, however, see in the newspapers of the past few days the beginning of another great movement under commercial and shipping interests, which appears very hopeful. This movement, moreover, is even being officially endorsed by the diplomats of our sister republics at the south, and I might add that I leave in two weeks for Chile and Argentina in connection with this work. In fact, the "Neutrality Commission of Nine," recently appointed by the Pan-American Union is a most hopeful sign of the two probabilities to which I refer above—namely: (1) That the war will be short, and (2) that a commercial alliance may be formed which will make another such war very improbable.

If the leading nations come together in a commercial alliance to neutralize the seas, regulate trade-barriers, and assure all member nations equal commercial protection, this will be the beginning of a great development in international statistics. It will lead to standardizing the censuses and all the vital commercial and industrial statistics of the different nations. As the development of the simplest form of national government was dependent on collecting statistics for proportioning representation, taxation, etc., so the development of any international alliance or federation will carry with it the extension and standardization of international statistics.

Did you ever think that political revolutions exist today as in the past, excepting that we make armed fighting unnecessary? Every four years before there is a chance for an armed conflict, we count the conflicting parties and if we see that one side has enough more males to win than the other, we call them the victors from the result of such a count. In other words we let both sides fight; but insist that they fight statistically with ballots, instead of in a mediaeval fashion with bullets. Hence, I believe that not only will this new international movement bring about the much hoped for development of international statistics, but that the wars of the future may be fought with

statistics and ballots instead of with guns and bullets. Certainly, it must be with one of these two classes of weapons, as the world can never remain *in statu quo* as the pacifists so supinely hope. In view of this possible development I conclude as follows:

1. That, granted the existence of certain glaring needs to which President Koren, and Messrs. Willcox, Meeker, Mitchell, Durand, and Gifford have so ably referred, the statistical work of the United States Government has now reached a point where it should at once seek to coöperate with other governments in standardizing the census and statistical work of all nations.

2. That this means the formation of some sort of an official international census office entirely apart from the excellent work of the International Statistical Institute at The Hague.

3. That the duty of the American Statistical Association,—the second oldest statistical association in the world and the only one of any consequence in a now neutral nation—is to call an international conference to consider this project.

4. And finally, that in the meantime, we individual members work and talk in favor of this proposed commercial alliance and the neutrality plan of our South American brothers, for if these are successful, international and national statistics will be put on a plane higher than we have ever yet dared to hope for up to the present time.

THE CENSUS OFFICE IN COMMISSION.*

By S. N. D. North, *Director of the Census, 1903–1909.*

I have read with much interest the article in the *Political Science Quarterly* for September, 1914, by Professor Walter F. Willcox, in which he gives a summary review of the long struggle maintained by the Director of the United States Census—from 1903 to 1909—to uphold the independence of that bureau in accordance with the letter and the spirit of the law.

As the Director in question, and thus the storm center of the movement to destroy the independence of the Census. I desire to add some particulars which Professor Willcox either overlooked or under-emphasized.

The matter is one of vital importance to the future of statistical science in the United States, and the statisticians should be fully informed as to the facts, in order that they may determine their duty.

Since I resigned the directorship of the Census in 1909, I have refrained from any public statement on the subject and avoided any defence of my own official conduct under circumstances which were unusual and trying. Now that another has revived the subject, and has reached the conclusion, after an impartial examination of the documentary history, that the position of the Director was "legally impregnable" throughout the whole period, I feel warranted in breaking this silence, disregarding the personal aspects of the controversy, which are of no consequence to the public.

A position which was "legally impregnable" at the time, so far from being "still open" as a legislative question, has been determined by subsequent legislation, the significance of which is not sufficiently understood. Discussion of the details of the controversy has become academic; but the legislation which was intended to end it, is the law of the land.

*A paper read at the Annual Meeting of the American Statistical Association, Princeton, N. J., December 29, 1914.

Professor Willcox has demonstrated that it was the intent of Congress, in passing the act of 1899 for the taking of the Twelfth and subsequent censuses, "to give the Director full control of the Bureau," an intent subsequently confirmed by the Attorney General. The Congress again made clear its intent when it passed the act for the establishment of the Permanent Census Office, which continued all the powers given the Director in the previous act, under which was produced the most satisfactory census ever compiled in this country. That the Congress had no intention of changing a census law which had so abundantly justified itself, when it transferred the Bureau to the newly created Department of Commerce and Labor, is shown in the debates, when this act was under discussion.

That Congress has never since had any such intention is made equally clear by the content of the two bills on the subject which have been passed by Congress since that transfer, the second of which is now the only law for the administration of the Census Office.

The first bill to provide for the Thirteenth and subsequent censuses was under consideration for a number of weeks in the Census committees of both houses. There were numerous hearings by both committees, and the details of the bill were carefully considered. At a hearing of the House Committee there was presented a letter from the Secretary of Commerce and Labor (Hon. Oscar S. Straus), dated January 15, 1908, in which he said:

"It is noted that the [Census] bill as it now stands, with the exception that appointments of certain persons in the Bureau proper shall be approved by the Secretary of Commerce and Labor, and that requests upon other Departments for information pertinent to the work provided for by the act shall be made by the Secretary, confers upon the Director of the Census all the duties of every description in connection with the census work independently of the Secretary of Commerce and Labor. This seems to me inadvisable."

The Secretary then set forth his objections to each specific paragraph conferring independent authority upon the Director, concluding with the statement that "the setting up of a

bureau within an Executive Department which is independent of its head, would constitute an administrative anomaly which it is believed it is not the purpose of Congress to create." He urged the committee to confirm by direct legislation, all the limitations upon the Director's authority and responsibility, which the Secretary of the Department had undertaken to establish by executive order or otherwise.

The Secretary was not familiar with the history of census evolution, and unaware that the whole question he raised had been decided in 1899, and again in 1903, after a full consideration. His letter was the first formal statement of the attitude of the Department on the issue it raised. After careful consideration of this letter, the committee voted unanimously against amending the bill as requested. It was reported to the House in its original form; it was there debated at length; no amendment was proposed embodying any of these proposals of the Department, and it was passed without dissent. The same thing happened in the Senate committee, and in the Senate itself.

In order to make the intent of Congress unmistakable, and to negative, once for all, the contention that by reason of the transfer of the bureau to the Department of Commerce and Labor, the independence and power of the Director had been submerged in the authority of the Secretary of the Department, section 33 was made to read as follows:

"That the Act entitled 'An Act to provide for taking the Twelfth and subsequent censuses,' approved March third, eighteen hundred and ninety-nine, *and all other laws and parts of laws inconsistent with the provisions of this Act are hereby repealed.*"

It will be recalled that this first bill for the Twelfth Census was vetoed by President Roosevelt. This veto was directed against two provisions of the bill: one relating to the method of appointment of the extra clerks to be employed and the other (upon which little stress was laid), permitting the Director to go outside the Government Printing Office, if he thought desirable, to secure the prompt publication of the Census reports. The provision of the bill relating to the appointment of the clerks authorized "non-competitive" exam-

inations, and grew out of the desire of Congressmen to have a hand in the appointment of these clerks without the restraint of the Civil Service law.

When the President sent for me to inform me of his intention to veto the bill, because of this provision, I pointed out to him that the provision was so clumsily drawn that it would be a simple matter for him to issue an executive order which would avoid the evil he foresaw, viz.: an order directing that appointments must be based upon the actual standing of applicants, as shown by the markings of the Civil Service Commission. He admitted this, but said that he must veto the bill nevertheless. "These people have given me a chance to read them a lesson," he added, "and I am going to do it." He went on to say, what he afterwards repeated in his veto message, that "Outside of these (two) matters, I believe that the bill is, on the whole, satisfactory, and represents an improvement upon previous legislation on the subject." (*Congressional Record.* Vol. 43, Second Session, Sixtieth Congress, p. 1965.) He further said to me that he recognized the fact that the decennial Census was a gigantic undertaking, and the officer in charge of it was entitled to be relieved of all such hampering difficulties as a struggle over spoils.

I record this interview, and quote this message, because they show that President Roosevelt was not in sympathy with the repeated efforts of three successive Secretaries of Commerce and Labor in his cabinet, to emasculate the Census law. He accepted without question every feature of the bill which restored to the Director all the authority and all the independence of which he had been deprived, or of which it was attempted to deprive him, by departmental orders and disingenuous opinions of legal officers.

Congress was reluctant to join issue with the President on the Civil Service issue and the bill went over to the new Congress, in which the personnel of the Census committees in both Houses materially changed. Judge Crumpacker was, however, again the Chairman of the House committee, and he shortly re-introduced the identical Census bill of the previous session, except that it was modified in the two particulars to which President Roosevelt had objected.

Again there were protracted hearings; again the bill passed the committee and the House, without opposition on the point at issue, and went to the Senate committee, which called the new Secretary of Commerce and Labor as an early witness. He did not reiterate the demands made by his predecessor in the previous administration, but contented himself with saying that as the head of the Department of which the Census Office was a bureau, he had to ask that the committee would report a bill which would show beyond any peradventure, just what was to be his official responsibility for the census about to be taken. He raised no objection, beyond this question, to the bill in the form it had once passed the Senate and twice passed the House.

Again the Senate committee approved the bill, and again the Senate passed it; and thus Secretary Nagel's single question was answered.

President Taft signed the bill reënacting the principle of the law of 1899; and the practical independence of the Census Office was apparently firmly reëstablished.

The significance of this legislation is emphasized by this brief résumé of its progress through Congress. Everything for which I had contended, as essential to the successful administration of a census, was confirmed by legislation now on the statute books. The new law removed all administrative questions from the region of doubt and beyond the reach of adroit writers of departmental "decisions." It was a victory for the cause of the non-partisan conduct of this great office, and it was won on the merits of the question. The question is no longer "open," so far as the law is concerned.

But it has been permitted to remain a barren victory; and it will continue to be, in practical effect, a defeat, unless steps are taken to effect the restoration of the Census Office to its legal position. I believe the students of conditions and experts in statistics and economics are agreed that otherwise the Permanent Census Office will fail to justify its establishment. It is obvious that this restoration can be effected by a stroke of the President's pen.

Experience has already demonstrated that an independent census office, in the true sense of the word, is not possible, so

long as the bureau continues to be subordinate to any of the great departments whose secretaries are cabinet officers, and whose under-officials are at liberty to interfere, in a thousand petty ways, with the conduct of a nominally independent but actually subordinate bureau.

It is not an easy nor pleasant duty for a Bureau Chief to oppose a policy which he knows the head of the Department has close at heart. It is all the more difficult, when personal and social relations are of the pleasantest character. Nevertheless, there was the plain and unmistakable letter of the law, and the oath to faithfully execute that law. When a new secretary arrived—the fifth under whom I served —whose hostile resentment of this attitude was at once apparent, there was no choice but to resign the charge of an office which practically had been put in commission, and which remains there today. From the date of my resignation, the Census Office has been administered in a manner that is openly and indisputably a violation of the letter and the spirit of the Census law.

I have added some details to an interesting and important chapter in our legislative and administrative history. I am unaware of any other instance in that history where a principle of law to govern a great public office, approved by three presidents, and by four Congresses, has been successfully nullified by Departmental order.

What are the lessons to be drawn from this experience? To my mind the fact has been demonstrated that an independent Census Office, subordinate only to the President, is essential to the proper and satisfactory administration of the great statistical factory of the federal government. As Professor Willcox says, it must be a non-partisan and non-political bureau, if its scientific results in many controversial fields of government action are to retain the confidence of the public and of Congress. It is not possible to keep it such, if it is subordinate to any department, the head of which will change with every change of administration. It is the one great bureau which must not be subject to the political mutations so common in the United States.

The unfortunate fact is, in regard to the Census, that its

political patronage is large, and at times enormous; and this patronage is bound to be utilized for partisan purposes, so long as the Director is a part of the political machine, by reason of his official subordination to a cabinet officer who is a vital part of that machine.

Another obvious fact growing out of recent experience is that an independent office is necessary to the economical and efficient management of the Census Office. The Thirteenth Census cost easily $1,500,000 more than it should have cost. Exactly what the expenditure actually has been, it is impossible to state; the sum will probably never be known, because the work has dragged on until within the last few months. The law required that the Thirteenth Census be completed and published within two years from the date of the enumeration. It had not been completed at the end of four years from that date; and this in spite of the fact that no census was ever taken in this country under conditions even approximately so favorable. The details of preparation were practically completed a year in advance of the enumeration—that is, the Thirteenth Census had a full year's start over any previous census, and was relieved of all the costs of this preparation. This lamentable showing may be attributed very largely, in my judgment, to the excessive red tape, the needless circumlocution, and the roundabout methods, which sprang from the reversal of the administrative methods prescribed by the law. The director in charge was the victim rather than the cause of the conditions set forth in the statements made above.

Four years from this winter, legislation for the Fourteenth Census of the United States will be under consideration. It is none too early for the statisticians and economists who are in session here, to take counsel of each other as to what course they can best pursue, under all the conditions, to best promote the interests of governmental statistics, and to secure their segregation, as a thing apart—their complete separation from and independence of any and all political interests. The facts related in this paper seem to justify the conclusion that the plan of an independent bureau, under or within a department of the government, has proved a failure, and must continue to prove unsatisfactory so long as the head

of the department of which the Census Office is a part, can be permitted to nullify the spirit and purpose of the law. Such controversies as that with which this paper deals are unfortunate, irrespective of the question of who is right and who is wrong. No such conflict can arise, if the office is made independent; and in no other way, this experience teaches, is there a fair chance that it can be kept free from the taint of partisan politics. Never, in my judgment, has the bureau been more completely and notoriously a part of the political machine than is the case today.

PROCEEDINGS OF THE SEVENTY-SIXTH ANNUAL MEETING OF THE AMERICAN STATISTICAL ASSOCIATION, PRINCETON, N. J., DECEMBER 28-31, 1914.

The seventy-sixth annual meeting of the American Statistical Association was held at Princeton, N. J., December 28–31, 1914. The following program was carried out:

PROGRAM.

MONDAY, DECEMBER 28.

8.00 p. m. First Session, 50 McCosh Hall.

Joint session with the American Economic Association and the American Sociological Society.

Presiding officer, Dr. John Grier Hibben, President of Princeton University.

Presidential Addresses:

John H. Gray, President of the American Economic Association, "Economics and the Law."

John Koren, President of the American Statistical Association, "Some Statistical Ideals."

Edward A. Ross, President of the American Sociological Society, "Freedom of Communication and the Struggle for Right."

TUESDAY, DECEMBER 29.

10.00 a. m. Second Session, 30 McCosh Hall.

The Relations of the Association to:

(*a*) Federal Statistical Bureaus, Frederick L. Hoffman.

(*b*) State Statistical Bureaus, Robert E. Chaddock, Leonard W. Hatch.

Discussion under the five-minute rule.

2.30 p. m. Third Session, 30 McCosh Hall.

The Relations of the Association to:

(*a*) Municipal Statistical Bureaus, Edward M. Hartwell.

(*b*) Public Service and Business Statistics, M. O. Lorenz, Julius H. Parmelee.

(*c*) Social Statistics and "Surveys," J. L. Gillin.

Discussion under the five-minute rule.

4.30 p. m. Reception at "Prospect" by President and Mrs. Hibben.

8.30 p. m. Smoker at the Nassau Club.

WEDNESDAY, DECEMBER 30.

10.00 a. m. Fourth Session, 10 McCosh Hall.

Round-table meeting with the American Economic Association. Discussion under the ten-minute rule.

The Statistical Work of the United States Government, Wesley C. Mitchell, Walter S. Gifford, Walter F. Willcox, E. Dana Durand, Roger W. Babson, John Cummings, Harvey S. Chase, Royal Meeker.
Discussion under the five-minute rule.

2.30 p. m. Fifth Session, 30 McCosh Hall.
Improvement and Extension of the Registration Service, Joseph A. Hill, Louis I. Dublin.
Discussion under the five-minute rule.

7.00 p. m. Subscription Dinner in Proctor Hall of the Graduate College.

THURSDAY, DECEMBER 31.

10.00 a. m. Sixth Session, 30 McCosh Hall.
Annual Business Meeting.

MINUTES OF THE BUSINESS MEETING.

Meeting called to order by President Koren at 10.15 a. m.

The reading of the minutes of the previous annual meeting was dispensed with owing to the fact that these minutes had already been published in the proceedings.

The Secretary presented the following report:

SECRETARY'S REPORT.

Mr. President and Members of the Association:

I have the following to report in regard to the condition of the Association:

Membership February 14, 1914, date of last annual meeting		683
New members added		37
Deaths during the year	9	
Resignations	28	
Dropped	2	
Total deductions		39
Present membership		681
Net loss		1
Beside members we have:		
Subscribers (mostly libraries)		205
Domestic Exchanges		37
Foreign Exchanges		117
Total mailing list		1,042

The death of the following members has been reported during the year: Honorary members, Archibald Blue, Wilhelm Lexis, and Robert Meyer; members, James A. Beaver, Robert Dornan, L. G. Fouse, Charles Fry, Henry Gannett, and J. H. Kingwell.

Four regular numbers of the QUARTERLY PUBLICATIONS have been issued during the year, containing an aggregate of 349 pages, or an average of 87 pages per number. In addition to these, a hand-book of 24 pages, containing the list of members, has just been issued.

The most noteworthy event of the year was the quarterly meeting and dinner of the Association at the Yale Club, New York City, December 11. Fifty-eight members and guests were present. The general topic of the evening—"The Potential Value of Statistics in Shaping Rational Public Opinion"—was presented by Henry Bruère, Chamberlain of the City of New York. The following speakers took part in the discussion: N. C. Kingsbury, vice-president of the American Telephone and Telegraph Company, on "The Service of Statistics to Business"; Carl M. Hansen, secretary of the Workmen's Compensation Bureau Service, on "The Need of Standardization in Accident Statistics"; Osmond Phillips, editor of the *New York Times*, "Annalist," on "Statistics for Public Consumption"; and F. H. Dixon, chief statistician of the Bureau of Railway Economics, Washington, D. C., on "Statistics of Railroads." This was one of the most interesting and profitable meetings ever held by the Association. It was clearly shown by the speakers that the Association has an ever growing and widening field of usefulness.

Respectfully submitted,

CARROLL W. DOTEN,
Secretary.

On motion, it was voted to accept the report of the Secretary and to authorize its publication in the proceedings in the March number of the QUARTERLY PUBLICATIONS.

Treasurer's Report.

January 1, 1914, to December 22, 1914.

RECEIPTS.

Membership dues	$1,162.27	
Sales and subscriptions	594.97	
Dividends and interest	113.00	
Balance on hand, January 1, 1914	541.95	
		$2,412.19

EXPENDITURES.

Printing	$1,079.27	
Postage	184.16	
Salaries and clerical service	389.82	
Expenses	17.64	
	$1,670.89	
Balance on hand, December 22, 1914	741.30	
		$2,412.19

ASSETS.

17 shares B. & A. R. R. stock @ 180 per share, $3,060.00.

S. B. Pearmain,
Treasurer.

Auditors' Report.

We have audited the accounts of the treasurer of the American Statistical Association, for the year January 1, 1914, to December 22, 1914, and counted the securities in his possession. We find the accounts accurately stated and the expenditures properly vouched.

Respectfully submitted,

Leroy D. Peavey,
Roswell F. Phelps,
Auditing Committee.

SEVENTY-FIFTH ANNIVERSARY FUND.

To December 26, 1914.

RECEIPTS.

Subscriptions	$901.00	
Received from dinners	159.00	
S. B. Pearmain	4.50	
C. W. Doten	7.15	
L. D. Peavey	3.00	
Interest on bank deposit	13.53	
		$1,088.18

EXPENDITURES.

Paid S. B. Pearmain for a check deposited on this account by mistake	$25.00	
Collection charges on checks	1.90	
Algonquin Club	287.40	
Stenographic and clerical work	95.00	
Balance on hand January 1, 1915	678.88	
		$1,088.18

SUMNER B. PEARMAIN,
Treasurer.

AUDITORS' REPORT.

We have audited the Convention Fund accounts of the treasurer of the American Statistical Association to December 26, 1915, and find the statements correct and the expenditures properly vouched.

Respectfully submitted,
LEROY D. PEAVEY,
ROSWELL F. PHELPS,
Auditing Committee.

On motion, duly made and seconded, it was voted to accept the report of the treasurer and report of the auditors, and to publish the same in the proceedings of the meeting.

It was moved and carried that a statement of the Anniversary Fund, held by the treasurer, should be printed in the proceedings of the meeting.

In accordance with the following resolution, adopted by the joint meeting of the American Economic Association and the American Statistical Association:

Resolved, That the American Economic Association and the American Statistical Association, here meeting in joint session, be requested to consider the expediency of appointing coöperating committees on the relations of these Associations to the statistical work of the federal government,

It was voted that the Board of Directors of the Association be empowered to appoint a committee of five, with authority to add to its own numbers, to coöperate with a similar committee of the American Economic Association in considering means of improving the statistical work of the United States government.

The following resolution was presented by I. M. Rubinow:

WHEREAS, the income tax law offers the first opportunity to obtain accurate statistics of incomes in this country, and whereas the present income tax blank is faulty in that it fails to record the profession or occupation of the income taxed, be it

Resolved, That the American Statistical Association request the Bureau of Internal Revenue to include the proper query as to the occupation of the tax payer in the income tax return blank of 1915.

On motion it was voted to refer the foregoing resolution to the committee on Federal Statistics, with power to act.

It was voted, on motion of Mr. Hoffman, that three other committees, similar to the committee on Federal Statistics, to consist each of five members, with power to add to their membership, be appointed by the Board of Directors, as follows:

1. On State Statistical Work.
2. On Municipal Statistical Work.
3. On Business Statistics.

On motion of Mr. Babson, a committee of the same number, to be appointed in the same way, was voted, to be known as the Committee on International Statistics.

It was further voted that each of the committees as above constituted should be authorized to appoint sub-committees from their own members or other members of the Association.

The committees above named have been appointed by the Board of Directors as follows:

Federal Statistics—T. S. Adams, F. L. Hoffman, J. Koren, L. W. Hatch, N. I. Stone.

State Statistics—E. Dana Durand, R. E. Chaddock, E. W. Kemmerer, H. J. Harris, Charles F. Gettemy.

Municipal Statistics—LeGrand Powers, L. I. Dublin, E. M. Hartwell, F. A. Cleveland, Fred C. Croxton.

Business Statistics—C. P. Neill, H. S. Person, W. S. Gifford, I. M. Rubinow, J. H. Parmelee.

International Statistics—Irving Fisher, Royal Meeker, Harvey S. Chase, M. M. Dawson, R. P. Falkner.

The following resolution was presented by Mr. Miles M. Dawson, and on motion was duly voted:

WHEREAS, the United States Senate has adopted a resolution calling upon the Commissioner of Labor Statistics to make an investigation of mortality and disability among persons engaged in different occupations:

WHEREAS, The Commissioner of Labor Statistics has expressed his willingness to perform this work and has asked for a special appropriation of $25,000 to enable him to do so,

Now, therefore, the American Statistical Association urges upon Congress the great importance of securing reliable information concerning mortality and disability among persons engaged in various occupations and the wisdom of making this appropriation to enable such information to be obtained and laid before the Senate.

It was voted to instruct the president of the Association to appoint a nominating committee of not less than three members, and to announce the membership of such committee not less than three months prior to the next annual meeting.

On motion it was voted to leave the time and place of the next annual meeting to be determined by the Board of Directors.

The secretary made a report for the Committee on Constitution and By-Laws, appointed at the last annual meeting of the Association. After some discussion of the draft of the constitution and by-laws presented by the committee, it was voted to refer the matter back to the same committee, and the committee was instructed to report recommendations at a date sufficiently early to permit of action on the same at the next annual meeting of the Association.

The Nominating Committee, consisting of E. M. Hartwell, W. S. Gifford, and C. W. Doten, reported the following nominations for office in the Association during the ensuing year: President, E. Dana Durand; Vice-Presidents, Charles P. Neill, Charles F. Gettemy, Joseph A. Hill, Edward B. Phelps, Charles H. Verrill; Librarian, Horace G. Wadlin; Treasurer, S. B. Pearmain; Secretary, Carroll W. Doten; Assistant Secretaries, Robert E. Chaddock, M. O. Lorenz; Counsellors, Frederick L. Hoffman, Walter F. Willcox, John Koren; Editor, William B. Bailey; Associate Editors, Frederick S. Crum, Louis I. Dublin, Julius H. Parmelee, Warren M. Persons; Committee on Finance, Miles M. Dawson, Walter E. Weyl, S. B. Pearmain; Committee on Library, Roger W. Babson, Edmund E. Day, Horace L. Wheeler; Committee on Nomination of Fellows, Frederick L. Hoffman, Irving Fisher, Frank H. Dixon, Cressy L. Wilbur, Carroll W. Doten.

On motion the report of the Nominating Committee was accepted, and it was voted to instruct the secretary to cast one ballot for the list as presented. This having been done, they were duly declared elected.

On motion it was voted that the retiring president appoint a committee of three with himself as chairman, to complete the work of editing and publishing the Memorial volume. He appointed as such committee, J. Koren, W. S. Rossiter, and C. W. Doten.

It was voted to instruct the secretary to express the sincere thanks of the Association to President Hibben of Princeton University, and to the various members of the faculty who had by their splendid coöperation provided such excellent opportunities for the meetings of the Association and for the entertainment of its members.

On motion a vote of thanks was extended to the retiring president, for his untiring services on behalf of the Association during the two years of his incumbency.

The meeting adjourned at 11.30.

CARROLL W. DOTEN,
Secretary.

REVIEWS AND NOTES.

PROPORTION OF AMERICAN MARRIAGES ENDING IN DIVORCE.

In the December, 1914, issue of this QUARTERLY (p. 310) the following paragraph is found:

> The statement frequently made that in this country 1 marriage in every 12 terminates in a divorce is a serious and inexcusable statistical error. In 1910, for illustration, there were 18,098,000 married males in the United States and only 156,000 divorced males. The ratio of divorced men to married men was, therefore, 1 to 116. The number of married women was 17,688,000, and the number of divorced women 185,000. The ratio of divorced women to the married was, therefore, 1 to 96. The annual divorce rate per one hundred thousand married population has increased, however, from 81 in 1870 to 107 in 1880, 148 in 1890, and 200 in 1900. The condition is alarming, but not as serious as frequently assumed.

This subject is of so much importance that it seems best to state briefly the reasons for doubting the validity of the argument quoted and for believing that the statement criticized is approximately correct. The fallacy in the argument lies in its neglecting the fact that the average duration of married life before death or divorce is many times as great as the average duration of divorce before death or remarriage. As a consequence of this fact the ratio of divorced men to married men or divorced women to married women in the community at any moment affords hardly the slightest clue to the proportion of marriages terminating in divorce.

The number of marriages contracted and of divorces decreed in the United States during the calendar year 1910, or any other year after 1906, is unknown; but the number in 1910 may be estimated by adding to the number in 1906 the increase between 1902 and 1906. On this basis there were in 1910 about 960,000 marriages. The census of that year showed 18,100,000 husbands and 17,700,000 wives, or 1 marriage a year to every 19 husbands and every 18 wives. These figures indicate that the approximate duration of married life before it ends by death or divorce is 19 years for men and 18 years for women. By a similar argument the number of divorces granted in 1910 may be estimated from the number granted in 1906 plus the increase between 1902 and 1906. If the result, 82,600 divorces, is compared with the number of divorced men and women reported in 1910, it would appear that the approximate duration of a divorce before death or remarriage is for a man 1.9 years and for a woman 2.2 years. Of course these durations are only rough averages, partly because the number of divorced persons is understated by the census, partly because the increase in the number of marriages year by year would affect the results, and partly for other reasons. But they do show that marriage lasts before death or divorce from eight to nine times as long as divorce lasts before death or remarriage and thus measure the fallacy of inferring from

the ratio between married persons and divorced persons at any moment the ratio of marriages ending in divorce.

The subject is discussed in the Special Report of the Census Bureau on Marriage and Divorce 1867–1906 (pp. 22–24). Several methods are used and the following conclusion is reached:

> At the present time the chances are that not less than 1 marriage in every 16 will ultimately be dissolved by divorce and it seems reasonable to suppose that the ratio is nearer 1 in 12.

A simple method of reaching much the same result was stated in a letter by the present writer, printed in the *New York Times* of January 24, 1909, and now slightly revised for republication:

> The following figures are taken from the returns for Massachusetts because the death records in that state are probably somewhat more complete than in New York, and Massachusetts comes nearer than any other registration state to the average for the registration area, if not for the whole country.
>
> In the year 1900 married persons to the number of 15,614 died in Massachusetts and 1,260 divorces were granted. Obviously 16,874 marriages were broken by death or divorce, 92.5 per cent. of them by death and 7.5 per cent. by divorce, or about one in thirteen by divorce.
>
> The facts for the ten registration states, including about 26 per cent. of the population of the United States, are similar. In those states there were in 1900 99,601 deaths of married persons and 8,661 divorces granted, a total of 108,262 terminations of marriage, 8.0 per cent. or nearly one in twelve of which were by divorce.
>
> The argument may be extended to include the entire United States in the following manner: In the entire registration area in 1900, including more than one third of the population of the country, the number of living married persons was 10,916,375, and the number of deaths among them was 167,737, or 15.4 per thousand married persons. In the entire United States in 1900 there were about 27,850,000 married persons. If the death rate of married persons in the registration area, 15.4, be applied to this total, the deaths in the country among married persons were 429,000.
>
> The divorces granted in the United States in 1900 were 55,751. Hence the total terminations of marriage in that year were about 484,750, of which 11.5 per cent., or more than one in nine, were by divorce. I am well aware that such a computation involves assumptions, the exact accuracy of which may be challenged, and I am not concerned to prove the perfect trustworthiness of the results. But as a first approximation to the truth, I believe the method is thoroughly sound, and that divorce now terminates not far from one tenth of all the marriages in the United States.

A few months later, at the twelfth session of the International Statistical Institute at Paris,* I examined the same subject before a group of experts and reached the following results:

During the twenty years 1887–1906 there were 64 divorces granted in the United States to each 1000 marriages solemnized, or 72, if we assume that all divorces granted to persons whose place of marriage did not appear on the record were granted to parties married in this country.

By a method applied only to the ten registration states of 1900 in every thousand dissolutions of marriage 80 were by divorce and 920 by death;

* See International Statistical Institute, *Bulletin*, Vol. XVIII, Pt. I, pp. 609–623.

but after allowing for the fact that the divorce rate in the other states was much higher than in the registration states, the conclusion was reached that in each thousand dissolutions of marriages about 115 were by divorce and the remainder by death.

In view of all the evidence, it appeared that at least 8 out of every 100 marriages contracted in the United States would end in divorce. To this conclusion, however, the following important qualification was added:

It does not follow that this proportion, or anything like this proportion, obtains among those marriages which are celebrated between bachelors and spinsters. The fallacy involved in such an inference may be illustrated by assuming two cases.

1. Suppose 1,000 marriages between bachelors and spinsters of which 920 are finally broken by death and 80 by divorce, the surviving or divorced parties to these marriages continuing to live as widowed or divorced persons until death.

2. Suppose 940 marriages between bachelors and spinsters of which 920 are broken by death, the surviving parties in no case marrying again, and 20 are broken by divorce each one of these 40 divorced persons remarrying within that group and being again divorced. Suppose this process to continue until each one of the 40 persons has been married and divorced four times after which no new marriages are contracted.

In both cases we have to deal with 1,000 marriages and 80 divorces but in the first case 8.0 per cent. of the 1,000 marriages between bachelors and spinsters end in divorce and in the second case only 2.1 per cent. of the 940 marriages between bachelors and spinsters end in divorce. It is probable that the average conditions in the United States lie between these two hypothetical extremes but where they lie we do not know and cannot tell until trustworthy statistics are obtained regarding the previous marital condition (single, widowed, divorced) of all parties who enter upon married life. Until such statistics are secured I see no means of answering the vital question—What proportion of the marriages between bachelors and spinsters now end in a divorce?

WALTER F. WILLCOX.

Cornell University.

The Cancer Problem. William Seaman Bainbridge. The Macmillan Co., New York, 1914. Section III—Statistical Considerations, pp. 70–105.

A statistical chapter written by one who relies mainly upon other methods and uses statistics as a supplementary tool does not arouse high expectations and is not to be measured by exacting standards. With this qualification in mind, the chapter in the present work entitled "Statistical Considerations" deserves high commendation. Most of its constructive results are probable, if not established. The author wisely relies for the most part upon the work done by Newsholme, Bashford, and especially the English Registrar-General, from which sources he quotes at length. He also shows the lack of any connection between the cancer death rate and overcrowding, the non-existence of "cancer houses," the minor rôle played by heredity in the explanation of cancer, the independence of the two diseases, cancer and syphilis, and the error in the common opinion that Jews are exempt from the former scourge.

On the crucial question whether cancer is actually increasing or whether the increase in the death rate from this cause is due partly to a change in the age composition of the population but mainly to improved diagnosis, he takes the conservative and safe position that it "has not yet been decided" (page 104).

On two points perhaps a word of suggestion may be in place. No reference is made to a distinction of much importance for the question of increase, that between cancer as a disease and cancer as a cause of death. The author, as a physician and pathologist, may be supposed to be interested mainly in cancer as a disease, yet all his statistics relate to cancer as a cause of death. To be sure, no other figures exist; but this fact hardly relieves him from the duty of suggesting that what is true of the one may be far from true of the other, that, for example, cancer as a disease may be increasing even if cancer as a cause of death is not.

Again, one cannot but regret that a physician and especially an American physician should have spoken so slightingly of American vital statistics, even though he does it in good company. He returns to this topic several times and in doing so makes the only serious mistakes which I have noticed. Doubtless American cancer statistics of importance do not run far back and in many states are still lacking. But the statement that in this country "there are no reliable statistics concerning either the relative frequency of cancer in the past as compared with the present, or its relative frequency in different states, in different towns, or in town as compared with country districts" (page 74) can be defended only by giving the word "reliable" an emphasis not warranted by the context of the sentence quoted. The cancer statistics of Massachusetts run back to 1850, those of Providence, R. I., to 1856, and these figures are probably as "reliable" as those of Scotland, Ireland, or Germany. It is not true that European vital statistics are reliable in a sense in which American vital statistics are not. The main differences between the two are that American vital statistics in this and many other fields cover a shorter period of time and a smaller proportion of the population and, more serious still, that, owing to the lack of knowledge of vital statistics among American physicians, what figures we possess have been comparatively little utilized in the study of such questions as are of interest primarily to physicians.

WALTER F. WILLCOX.

Cornell University.

The Anthracite Coal Combination in the United States, with some account of the Early Development of the Anthracite Industry. By Eliot Jones, Ph.D. David A. Wells Prize for the year 1913–1914. Cambridge: Harvard University Press, 1914.

In this day of trust busting and combination pruning any volume that truthfully relates the origin and growth of such organizations is refreshing. Historically interesting and statistically severe, the volume in question proves its worth by inciting the reader with the desire of a closer acquaintance of the subject in hand. The volume is a comprehensive study of the combination movement in the anthracite coal industry. It sets forth the birth, growth, and final attempt of the government to dissolve the resulting combination. The moving spirits in the combination are the railroads, "owning either directly, or indirectly through subsidiary coal companies, substantially the entire area of the anthracite coal deposits of the United States."

The author roughly divides the history of the industry into four periods: "the first, extending from the middle of the eighteenth century to 1834; the second, from 1834 to 1873; the third, from 1873 to 1898; and the fourth, from 1898 to the present time." Each period developed its own means of transportation. In the last period came the development of the combination which called forth the study.

Although there are other anthracite deposits to be found in the United States, those in Pennsylvania are more fully developed and form the warp about which the author weaves his evidence, historical and statistical. This district is divided into three fields; the Wyoming, the Lehigh, and the Schuylkill. Each field presents its own problems which are vividly set forth. The beginning chapters, truly historical, form an appropriate background from which the remaining chapters, the period of combination, and resultant efforts at pruning, stand forth in bold relief. The characteristic features of the combination development set forth are: first, railroad consolidation; second, the development of a community of interest among the railroads; and third, the practical elimination of the independent operators. The production of coal and its transportation, the price and sale of the same all come in for careful and scientific discussion.

The conclusion of these chapters stated in brief are these: All the anthracite coal mined is controlled by certain railroads; these roads are working in harmony in the fixing of rates and prices. This condition calls forth a chapter on the Legal Status of the Combination in which the author presents the numerous attempts made to dissolve it; the final conclusion being that the problem of public ownership of the natural resources of the country versus private ownership under public regulation is still to be solved. As yet the United States have no definite policy. Until such a policy is adopted, a permanent solution of the anthracite coal problem is not to be expected.

New Haven, Conn. J. L. Deming.

NATIONAL REGISTRATION OF BIRTHS AND DEATHS.

An article of considerable interest to statisticians appeared in the *Illinois Law Review* for January, 1915. It is written by Dr. Henry B. Hemenway and bears the title "National Registration of Births and Deaths." The author points out the legal difficulties which are often encountered from the fact that our states do not require, in all cases, registration of births and deaths. A man residing in one state may wish for certain purposes a proof of his date of birth, and if he was born in a state which does not require the registration of births, much difficulty may be experienced. The Constitution requires that persons holding the office of representative, senator, vice-president, and president shall have attained a certain age. The passage of child labor legislation requires in most cases a certificate of date of birth. Where a person desiring to obtain work in one state was born in a state with no registration of births, it is sometimes difficult to establish a date of birth. Dr. Hemenway argues that under such circumstances Congress should have authority to provide for suitable registration of births.

The author advises that the Gordian knot be cut by a federal law requiring every state to register births and deaths. In those states which have not taken any steps in this matter, the state authority should be ignored and a service established by the federal government.

W. B. B.

HOW DO THE GERMAN PEOPLE GROW IN ONE HOUR?

Translation of an article on the growth of the German people which appeared in the monthly paper of the Victoria in Berlin, No. 8, 1914.

There are, perhaps, few people who know that Germany had in each hour, according to statistics for 1910, 225 births and 125 deaths, so that the German people have an excess of births over deaths of 100 in each hour. How this movement of the population takes place in one hour is visualized by means of a large board which is displayed at the present exhibition for physical culture in Stuttgart. In Germany a child is born every 16 seconds and a person dies every 28 seconds which events are indicated by red and black flashing lights. When the hour hand marks the hours, there appear 116 male and 109 female births; six times in one hour a stillbirth is indicated, and twice in one hour twin births. Considerably slower than life does death work, but still too fast for our state of civilization. Every 1½ minutes there dies in Germany an infant (20 boys and 15 girls in one hour). This mechanical device also illustrates certain causes of death: Every 4½ minutes there occurs one death from tuberculosis, every 10 minutes one from malignant disease; three times in one hour a person dies by an accident and twice suicide is committed. There die in Germany more people by accident and suicide than from diphtheria, scarlet fever, measles, and typhoid taken together. At the end of one hour we see the net result: The German nation has increased by 100 lives.

F. L. H.